New York State

WATER RESOURCES MANAGEMENT STRATEGY

January, 1989

New York State Water Resources Planning Council

New York State Department of Environmental Conservation
New York State Department of Health

NEW YORK STATE

WATER RESOURCES MANAGEMENT STRATEGY

JANUARY, 1989

APPROVED BY: NEW YORK STATE WATER RESOURCES PLANNING COUNCIL

PREPARED BY: NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
NEW YORK STATE DEPARTMENT OF HEALTH

WRPC

WATER RESOURCES PLANNING COUNCIL

TO: ALL INTERESTED PARTIES

On behalf of the **WATER RESOURCES PLANNING COUNCIL**, a body created by the New York State Legislature in 1984, I am pleased to announce the approval of this statewide water resource management strategy. The Council has also approved water resource management (substate) strategies for each of 13 regions of New York State.

These "strategies" are intended to provide for each of the regions of the state "...a framework upon which future specific actions that respond to water supply needs..." would be based. The Legislature, in assigning the Council the responsibility of approving such strategies on a biennial basis, recognized that water resources planning and management issues had to be addressed as an evolutionary process. Such a process explicitly acknowledges that climatic, ecological, hydrologic, demographic, and socio-economic changes greatly influence and affect the availability and uses of the water resource.

In the course of developing these strategy documents we were pleased to find that water resources, particularly as they relate to the quantity and quality of drinking water supplies, are matters of great concern and interest to the general public, environmental and public interest groups, and public officials and is indicative of the importance these resources play to the economic and social viability of New York State.

As the Water Resources Planning Council begins the process of reviewing this and all other strategy documents in fulfillment of its statutory obligations it welcomes comments, suggestions and recommendations.

Respectfully,

Walter R. Lynn

Walter R. Lynn, Chairman

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WATER RESOURCES PLANNING COUNCIL

1988

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A RESOLUTION
WRPC-88-14

WHEREAS, the New York State Department of Environmental Conservation and the New York State Department of Health surveyed municipal water supply systems in order to determine their current and future water needs; and

WHEREAS, the Department of Environmental Conservation and the Department of Health gathered information on agricultural, commercial and industrial current and future water needs; and

WHEREAS, the Department of Environmental Conservation and the Department of Health held public information meetings to gather information and opinions from interested public parties on this strategy; and

WHEREAS, the Water Resources Planning Council held public hearings on this strategy in order to receive public responses to the Department of Environmental Conservation and Department of Health recommendations; and

WHEREAS, the Department of Environmental Conservation and the Department of Health revised and modified their draft recommendations in response to many of the suggestions and comments provided by members of the Water Resources Planning Council, as well as those offered at the public hearings and meetings; and

WHEREAS, the New York State Water Resources Management Strategy shall be the general framework and conceptual basis for recommendations for water supply planning and actions;

THEREFORE, BE IT RESOLVED,
That the Water Resources Planning Council hereby approves the New York State Water Resources Management Strategy.

William H. Lee
Executive Secretary

Walter R. Lynn
Chairperson

12/8/88
Date

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EXECUTIVE SUMMARY

New York State Water Resources Management Strategy

New York State receives more water in precipitation than it uses to support its population and is therefore regarded as water-rich. However, droughts and population concentrations cause periodic water shortages, particularly in southeastern New York. The frequency of these problems is unacceptably high. Distributing water resources to these areas is becoming an increasing concern. The New York City system, for example, today uses an average of nearly 300 million gallons per day (mgd) more than its calculated safe yield. An approach that combines demand reductions and supply supplements will be needed to continue providing adequate quantities of drinking water into the 21st century.

The New York State Water Resources Management Strategy evaluates the water resource problem in detail. It analyzes management, financing and the problems presented by different geographies and population densities around the state. Strategies prepared for 13 substate regions contain additional recommendations for managing particular regions' water resources. This statewide strategy recommends actions for major regional issues in southeastern New York which affect the state's water resources as a whole in addition to statewide issues. The goal of this strategy is to ensure the availability of reliable supply when and where it is needed, in adequate quantity and quality, at reasonable cost, consistent with sound environmental practices.

The strategy is intended to be an evolving document, responsive to needs and conditions throughout the state. It provides the guidelines for developing an ongoing Water Resources Management Program. The Strategy will be reevaluated and revised, as necessary, every two years beginning in 1990, to reflect changing times and circumstances.

The New York State Departments of Environmental Conservation and Health are the lead agencies. However, implementation of the strategy will require the combined efforts of state and local governments, public and private water purveyors, and water users who draw from municipal systems or from their own supplies, in all economic sectors.

The Strategy includes recommendations for a wide range of state and local actions to improve water resources management and supply systems in the state. Some actions will need extensive funding, and some will cost little or nothing. Many of the recommended improvements are already begun. The strategy recommendations will also require new legislation, a summary of which is in Chapter V. The major recommendations are as follows:

1. Major Regional Issues - Southeastern New York

   Adequacy of supply for the New York City system is a major concern in southeastern New York and for the state as a whole

because the system serves almost half the state's population. Normal demands on the system now exceed the dependable yield by about 300 million gallons per day. The city experienced water shortages in the 1980-1981 and 1985 droughts, and severe water use restrictions were necessary. Even with conservation, a deficit of 300-800 mgd has been estimated for the year 2030. The ongoing detailed water demand study must be completed to determine the projected water supply deficit more accurately. Water conservation and metering programs, short-term supplemental supply actions and long-range planning are required to meet demands on the New York City water supply system.

Long Island's vast aquifer system is the largest and most important groundwater resource in New York State. It is the only source of drinking water for over three million people. High demands on the aquifer have stressed the system. The aquifer also is particularly vulnerable to pollution from development and associated sources of contamination. Increased concern about the magnitude and complexity of groundwater problems, particularly the threat of pollution by toxics, led to a review of resource management needs and development of the Long Island Groundwater Management Program (LIGMP). The LIGMP Report (DEC, June 1986) contains the framework for program actions to protect and improve the quantity and quality of groundwater. The LIGMP recommendations should be implemented.

2. Water Conservation and Metering

The state should require each water supplier serving more than 5,000 people to have a water conservation plan. The state should establish clear guidelines, conservation goals and provide technical assistance to suppliers on how to calculate and document water conservation savings and report on such savings.

State law should mandate universal metering of all major self-supplied water uses and all public water supply systems, including both service connections and production sources, within ten years. Although agricultural self-supplies and household wells would not be included except when already mandated by law, the agricultural component will be monitored by statewide representative sampling and monitoring.

Water conservation measures and metering of public water systems are most needed in the New York City supply system and on Long Island.

3. Infrastructure Improvement

The capital improvement estimates for all water supply systems surveyed in the regional studies total $9.224 billion, including $8.986 billion for the large systems and $238 million for the small systems.

The information to estimate infrastructure needs was derived from water system operators, from the most recently published engineering reports, and data on file in local and state government offices. Proposed projects were reviewed for overall compatibility. All systems serving 5,000 or more people (large systems) were surveyed. A representative sample of systems serving less than 5,000 people (small systems) were surveyed. The cost of the infrastructure needs of the small systems not surveyed was extrapolated from the surveyed system's costs.

As a first step in meeting these needs, the state should establish a program to provide technical and financial assistance to municipal and investor-owned public water supply systems, to complete detailed system studies of improvement needs and to prepare capital expansion and improvement plans.

Programs to generate this money are suggested, the most desirable of which is a leveraged equity loan program discussed in Chapter III.

4. Registration of Major Water Supply Withdrawals

To gain crucial data on how much and where water is used and to help sustain the capabilities of the state water resources to serve present and future users, the state should enact legislation requiring registration with DEC of any withdrawal of water exceeding 100,000 gallons per day during any 30-day period, anywhere in the state.

In addition, the state should evaluate the need to establish permit programs or an allocation system for other uses in addition to public water supply.

5. Water Quality Protection

Greater efforts are needed to protect and preserve water supply sources through vigorous enforcement of water pollution control laws, more effective watershed rules and regulations and stronger local land use controls. The state Department of Health should consider mandating filtration of all surface water supplies and should develop priorities for compliance. All water suppliers serving more than 5,000 people should report annually to their customers on issues affecting the water supply, including specific water quality data.

The state Department of Health and localities should continue working to achieve adequate treatment of groundwater, to monitor for contaminants, and to promulgate and implement state standards for organic chemicals in drinking water.

6. Improved Management of Small Water Supply Systems

The state should expand existing programs to improve the physical condition, operation and management of small water supply systems (those serving fewer than 5,000 people.)

Such programs should also provide technical and financial assistance to small systems on water resources and adequacy of supply, including water conservation. The Department of State should continue the Self-Help Support System to assist small communities in using their own resources to alleviate local water supply problems, including system operation, maintenance, financing and management.

7. Data Needs

An adequate and reliable data base is essential to manage water resources. Existing data are not integrated, there are significant data gaps, and the reliability of data is often suspect. The state should develop an expanded data base that will provide the character and quality of information required for sound water resources and water supply management. The state should integrate and coordinate state, federal, and local agency programs relating to water resources data in order to facilitate data collection, storage, retrieval, and analysis.
The state should establish uniform criteria and methodologies for determining dependable yield of surface and groundwater sources and provide technical assistance to water suppliers for making these determinations.

It is imperative that this program go forward if our precious water resources are to remain the strength of the Empire State.

Summary of Recommendations in the Statewide Water Resources Management Strategy

Background

New York has an abundance of good quality water that historically has provided safe and reliable supplies for domestic and municipal purposes, industry, agriculture, power generation, recreation and fish and wildlife. However, recent water shortages due to drought, increased contamination of groundwater supplies, increased water demands and the deteriorated condition of water supply systems point out the need for a sound, efficient water resources management strategy for the state.

The New York State Water Resources Management Strategy has been developed in response to this need. The strategy is designed to meet the water supply requirements of residential, agricultural, industrial and commercial users and to assure the highest possible quality and quantity of New York State's water resources. The strategy includes recommendations for a wide range of state and local actions to improve water resources management and water supply systems in the state.

Recommendations

A. Water Quantity

1. Water Conservation

The state should:

- Require each large water supplier serving more than 5,000 people to have a water conservation program as part of a water supply management plan.
- Establish clear guidelines on how to calculate and document water conservation savings and require large water suppliers to report on savings.
- Help large water suppliers evaluate the benefits, reliability, and economic, environmental and social costs of water conservation measures in their conservation plans.
- Provide technical assistance on long-term and emergency demand management, leakage and waste control, conjunctive management, operating rules, and public education and information to water suppliers.
- Require large water suppliers to file reports with the state containing specified information; report annually to their customers on water-related issues, including conservation; and use billing formats that highlight water use.

- Provide guidelines for large water supplies to establish water conservation goals based on water supplier specific information.

- Identify special problem areas.

- Evaluate modifications of the state low flow fixtures law.

- Conduct feasibility study on retrofitting water saving plumbing fixtures in state facilities.

- Establish and maintain comprehensive public information and education programs on water conservation.

- Advise businesses, industries and institutions to reduce water waste.

- Retrofit plumbing fixtures in state government facilities.

Localities, should develop comprehensive water conservation programs that include measures to:

- Distribute water conservation materials.

- Conserve water used for public purposes.

- Retrofit plumbing fixtures in local government facilities.

- Promote water-saving plumbing fixtures in residences; consider the feasibility of a residential plumbing fixtures retrofit program.

- Incorporate the state low flow fixtures law into local codes.

- Make local plumbing codes more restrictive than the state law.

- Consider limitations on the size of turf planted areas (lawns).

- Establish a clear process for enforcement of local water conservation programs.

- Establish effective control over stolen water and unauthorized water use.

- Impose water use restrictions during droughts and other water supply emergencies.

2. New Water Supply Source Development

The state public water supply permit system should require water suppliers seeking to develop new sources to demonstrate that the following conditions have been met:

- They have effective water conservation programs in place.

- They are using existing sources as efficiently as feasible.

- They have made any feasible facility adjustments or expansions for the efficient delivery of water from existing sources.

- They have identified all alternative water supply sources.

The state should identify water surplus/deficit areas.

3. Registration of Major Water Supply Withdrawals

To better understand how much and where water is used and help sustain New York State's water resources to meet present and future uses, the state should enact legislation requiring registration with state Department of Environmental Conservation of any withdrawal of water exceeding 100,000 gallons per day during any 30-day period anywhere in the state.

4. Large Diversions and Consumptive Uses

The state should enact legislation establishing a DEC permit program to control large diversions and consumptive uses (more than two million gallons per day, during any 30-day period, anywhere in the state,) from all New York drainage basins.

5. Water Use Regulation

To more adequately protect sources from overuse the state should evaluate the need to establish permit programs or an allocation system for other uses in addition to public water supply.

6. Instream Flow Management

The state Department of Environmental Conservation should:

- Adopt a policy and develop criteria for minimum flows in all streams to balance competing uses, with drinking water supply receiving the highest priority.

- Review all impoundments in the state to identify problems and opportunities to balance competing uses through instream flow management.

- Make recommendations to minimize impacts upon fish and wildlife resources and other instream uses such as recreation, transportation, navigation, and power generation.

- Require that new water intake structures be designed to minimize impacts to aquatic organisms, and that impacts of existing structures be reviewed during license or permit renewal processes.

7. Economic Development

The state departments of Economic Development and Environmental Conservation should help municipalities to use their available excess water supply capacity to promote economic development which takes advantage of available water supplies, and should guide water-intensive development toward areas with readily available supplies in a manner consistent with other resource management objectives.

Localities should consider the availability of water when making local land use and economic development decisions.

B. Water Quality

1. Protection of Water Supply Sources

The state Department of Environmental Conservation should:

- Continue to vigorously enforce state water pollution control laws.

- Set priorities for environmental management programs (e.g., discharge permits, solid and hazardous waste disposal, hazardous waste site cleanup) to take into account water quality protection for water supply sources.

- Continue to ensure that state standards and classifications for surface water and groundwater are adequate to protect water supply sources.

- Link compliance with discharge permits for sewage treatment plants to state assistance on operation and maintenance and disseminate information on permit violations to all concerned local entities.

- Require the continuous disinfection of wastewater tributary to sources of public water supply through SPDES permits as necessary.

- Take steps to assure full implementation of the federal and state sole source aquifer programs, including the Incompatible Uses Law.

- Provide technical assistance and information to local governments on protecting water supply sources.

The state Department of Health should:

- Continue to vigorously enforce state drinking water protection laws and regulations.

- Ensure that state drinking water standards are stringent enough to protect public health and safety.

- Issue final guidelines for watershed rules and regulations programs, require watershed rules and regulations programs for all water suppliers, and develop a program for enforcement of approved watershed rules and regulations.

- Require water suppliers to report annually on water quality.

The two departments jointly should:

- Ensure that surface water, groundwater and drinking water standards are coordinated for consistency.

- Identify priority areas for watershed protection, establish special standards for critical watershed protection areas.

- Develop alternative methods for watershed protection, involving coordination among state programs for control of point and non-point sources, watershed rules and regulations, and protection of sole source aquifers and wellheads.

Local governments should adopt and aggressively apply watershed rules and regulations or land use controls to protect water supply sources including land acquisition program.

2. Water Treatment

DOH should require filtration of all vulnerable surface water supplies and develop guidelines and priorities for compliance, and also should consider mandating filtration for all other surface water supplies.

Local governments should initiate efforts toward the construction of filtration facilities on surface water supplies.

The state should provide technical and financial assistance to small water supply systems for treatment facility planning.

DOH and localities should continue working to achieve adequate treatment of groundwater, to monitor for contaminants, and to promulgate and implement state standards for organic chemicals in drinking water.

C. Water Supply System Management

1. Water Rates That Reflect the True Cost of Water

To achieve the goal of charging the true cost of water, DEC, DOH, PSC and Office of the Comptroller should:

- Establish uniform accounting procedures, including a separate water account, for better financial control and more effective management of water supply systems.

- Establish guidelines and audit procedures for determining the true cost of water, including costs of both water supply and sewerage where one utility provides both services.

- Condition state financial or technical assistance upon water utilities charging the true cost of water.

- Repeal the current provision making water districts ineligible to accumulate capital reserve funds.

2. Water Metering

State law should mandate universal metering of all public water supply systems, including both service connections, and production sources and metering of major self-supplied water uses, within ten years. Agriculture and Household wells would not be included except where already mandated by law and/or are significant users.

Localities should be required to maintain accurate records of water consumption by major categories so that rates and billing can be tied to use, and unaccounted-for water can be identified and corrected.

3. Supply Management

DEC should provide technical assistance to water suppliers on sound management of current supplies, including measures for long-term and emergency demand management, leakage and waste control, operating rules, conjunctive management and public education and information.

4. Improved Management of Small Water Systems

DOH should continue to place emphasis on the regulation of small systems in order to improve the physical condition, operation and management of small water supply systems.

DEC should provide technical assistance to small systems on water resources and adequacy of supply, including water conservation.

The Department of State should continue the Self-Help Support System to assist small communities in using their own resources to alleviate local water supply problems.

DEC and DOH should develop a computerized uniform data collection and reporting system and provide training for small system operators.

Localities should:

- Improve operation, maintenance, financing and management of small systems.

- Overcome the limits of small systems by assisting small systems to join with others through such measures as regionalization, privatization or joint service contracts.

5. Regional Water Supply Systems and Interconnections

To encourage regional water supply systems and interconnections, DEC and DOH should:

- Further identify opportunities for regionalization and interconnections and determine necessary research, studies, or analysis.

- Make a detailed assessment of impediments to regionalization and ways to overcome them.

- Provide technical assistance to localities to investigate regional water systems and interconnections.

- Require interconnections between water supply systems for permanent use where technically, economically, and environmentally feasible, and for temporary use during emergencies.

6. Water Supply Planning

DEC and DOH should require suppliers providing water to more than 5,000 people to submit water supply management plans, that include:

- A water conservation program.

- Assessment of the safe yield and capacity of existing sources and facilities.

- Analysis of present and future demands, including the evaluation of the effectiveness of water conservation.

- A source and facility development program to meet current and projected demands.

- A system rehabilitation and improvement program, and preventive maintenance plan.

- A capital expansion and improvement plan.

- A contingency plan, including emergency sources (especially for droughts), interconnections for flexible and reliable system operation, water use restrictions, emergency response, and other appropriate actions.

- The creation of or revision to watershed rules and regulations.

DEC and DOH should provide technical and financial assistance for preparation and implementation of water supply management plans, including a guidance manual and pilot management plan.

DEC and DOH should ensure that the management plans prepared by suppliers and counties are mutually consistent and are consistent with this statewide strategy.

DOH should require community water suppliers to prepare and submit emergency plans in accordance with recent legislation.

DEC and DOH should conduct comprehensive water resources planning in preparation for revisions of the statewide and substate strategies. Such planning should be directed toward both site - specific programs and projects and further development of the substate strategies.

D. Water Supply System Improvements

The state should establish a program to provide technical and financial assistance to municipal and investor-owned public water supply systems to complete detailed system studies of improvement needs and prepare capital expansion and improvement plans. These plans should be consistent with the statewide and appropriate substate strategies.

DEC, DOH, Comptroller and the state Public Service Commission should develop uniform accounting procedures, establish audit procedures to determine the "true cost" of water, and improve each community's ability to represent its need for and its financial capacity to support capital projects to rehabilitate, improve, or expand existing water supply systems.

DEC, DOH and PSC should assist water suppliers to establish water service delivery goals based on state policies and local conditions.

The state should establish a capital reserve fund from funds obtained primarily through federal grants to provide low interest revolving loans to water suppliers to improve water supply systems.

The state should continue to seek and support federal technical and financial assistance for improvement of water supply systems.

Local governments should continue to establish local water authorities to obtain the capacity for revenue bond financing and for other benefits provided by authorities.

E. Data and Research

The state should integrate and coordinate state, federal, and local agency programs relating to water resources data in order to facilitate data collection, storage, retrieval, and analysis.

The state should develop an expanded data base that will provide the character and quality of information required for sound water resources and water supply management.

To obtain adequate water quantity data the state should:

- Complete regional mapping of surficial waters across the state.
- Support the National Weather Service climatological data program.
- Expand the present cooperative data program on water resources between the state and the U.S. Geological Survey.
- Establish a statewide well registration program.
- Require statewide registration of well drillers.

To obtain adequate water use data the state should:

- Utilize an integrated standard data base for all water use data in the state, and develop a computerized data base management system, such as a GIS.
- Require major (more than 100,000 gpd during any 30-day period) self-supplied users to file quarterly reports on monthly and maximum day use.
- Develop improved estimates of present and projected self-supplied water use.
- Establish an agricultural water use data research and monitoring system to develop improved and reliable estimates of present and proposed agricultural water use.
- Compile and integrate data on other water uses, such as power generation, navigation, and recreation.

Water suppliers should be encouraged to purchase and use micro-computers for their data collection and reporting system, where appropriate, and the state should provide a computer program and training.

The state should establish uniform criteria and methodology for determining dependable yield of surface and groundwater sources, and provide technical assistance to water suppliers for making these determinations.

The state should evaluate supplemental irrigation water use and establish a supplemental irrigation technology program.

Research Needs

The Water Resources Planning Council with the assistance of the New York State Water Resources Institute, should establish a research agenda, based on broad input and review, giving priority consideration to areas of research most needed to further development of the water resources strategy for New York State.

F. Public Awareness, Education, and Involvement

DEC, DOH and other agencies within state and local governments should coordinate and expand public involvement, and should develop new programs and materials to increase understanding of water resource management issues.

Substate Regions

These recommendations reflect findings of the substate water resources management studies. Full discussions of those findings can be found in the respective substate strategy documents. The two substate regions discussed in this document are the most significant in terms of changes and improvements which affect overall water resources management in New York State.

A. Delaware-Lower Hudson Region

1. New York City Water Supply Deficit

New York City should eliminate present and projected water supply deficits through an integrated program to reduce demand, supplement supply, and plan for droughts and emergencies to include:

- A long-term water conservation program requiring metering, water conserving plumbing fixtures, and leakage control.
- A detailed water demand study.
- Evaluation of potential sources for additional supply.

New York City should:

- Continue preliminary engineering planning for the possible development of Chelsea and alternative sites to determine the maximum potential capacity of the facilities acting as a supplemental supply and utilizing existing aqueducts. The planning should include provision for filtration of all water drawn from the Hudson. As soon as possible, a maximum practical pumping/treatment rate should be established taking into account site constraints, connections to and capacities of the existing City aqueducts, etc. Based on feasibility studies to date, it is expected that the maximum rate will be between 200 and 300 mgd.
- Due to the present uncertainty of actual and projected water deficits for the New York City system, short-term and long-term planning which addresses the development of supplemental supplies is prudent and should be continued. This planning activity should look at supply alternatives, demand management, water conservation, hydrologic, and ecological impacts, the high flow skimming project and groundwater development in order to provide a thorough cost-benefit analysis of all viable supply options.

The state should remain an active participant in New York City's water management planning program, and should:

- Support New York City efforts to develop and implement comprehensive water conservation and metering programs.

- Continue the joint effort with New York City and other regional interests to complete the detailed water demand study.

- Continue to participate in the evaluation of impacts of the water conservation and metering programs.

- Assist New York City in developing contingency plans for major droughts that may occur during the interim period before other actions to reduce the deficit are completed.

- Participate on the Mayor's Intergovernmental Task Force to evaluate alternatives for long-term water supply.

2. Regional Institutional Framework

The state and regional utilities should explore alternative regional institutional frameworks for long-term water supply management within the Delaware-Lower Hudson Region, in cooperation with local interests, and develop a mutually acceptable framework to be established in the region.

B. Long Island Region

To meet the special needs of Long Island (including Nassau, Suffolk, Kings and Queens counties), the state, with appropriate assistance from federal and local agencies, should:

- Maintain a comprehensive ground and surface water monitoring system, an island-wide hydrologic data base and an integrated data management system.

- Develop specific criteria for determining quantity aspects of the Region's water resource; identify present and future quantity shortfall areas; and require appropriate local agencies to develop specific plans to decrease consumptive water use in affected areas.

- Continue to enforce pumpage limitations and requirements for water conservation, where applicable, with adjustments as conditions and new information warrant.

- Continue to require water conservation plans from all Nassau County water suppliers and as part of all Long Island Well Permit Applications.

- Make additional investigations of the Lloyd and Magothy Aquifers in Nassau County.

- Coordinate state, regional and local groundwater management activities through annual meetings and program audits.

- Implement site-as-a-system management in select areas.

Nassau County should:

- Update and finalize the draft Master Water Plan for Nassau County to provide a clear framework for county water resource management activities.

- Conduct more detailed studies, including studies of environmental impacts, for development of an intra-county transmission system.

Suffolk County should:

- Implement recommendations of the Suffolk County Water Resources Management Plan.

- Via the Suffolk County Water Authority, efforts should continue to extend service into areas presently not served, particularly areas experiencing contamination of private wells.

New York City should prepare a Brooklyn/Queens Water Resource Management Plan, based on work already performed as part of the Section 205(j) Study.

Local governments and water suppliers should implement additional water conservation measures in areas where supply is a major concern, including all of Nassau County and the insular areas of Suffolk County.

The Long Island Groundwater Management Program is incorporated into this Strategy, and all pertinent agencies and interested parties should continue to implement its recommendations.

The Long Island Coordinating Council should meet on a regular basis.

C. Major Inter-Region Water Management

1. Conjunctive Management

New York State, New York City and appropriate federal agencies should investigate in detail all aspects of conjunctive management of New York City water supplies and Long Island groundwater and develop a definitive recommendation on the feasibility of this option for long range inter-region water management.

D. Upstate Groundwater Management

The Upstate Groundwater Management Program has been incorporated into the statewide water resources management strategy. The following recommendations are summary of some of the recommendations in the Upstate Groundwater Management Program report, December 1987.

The state should:

- Maintain existing groundwater classification and standards to support the policy objective that all fresh groundwater in the state will be preserved for the best usage as potable water.

- Establish sound and defensible standards for both drinking water and ambient water quality and reconcile any inconsistencies that may exist.

- Use the following order of priority for state actions affecting groundwater: wellhead, primary aquifer, including sole source aquifer, principal aquifer, other areas.

- Require all upstate public water supplies using more than 100,000 gallons per day from groundwater to define the wellhead areas of their supply wells.

- Evaluate the scope of rural drinking water problems and alternatives for state action.

- Conduct adequate monitoring programs for primary and principal aquifers and for public water supplies.

- Maintain the groundwater problem inventory.

- Maintain the Public Water Supply Well Closure List.

- Amend the Incompatible Uses Law to add upstate primary aquifers and implement the law.

- Encourage local governments to develop critical area protection programs for primary and principal aquifers and develop a technical guidance manual on local land use controls.

- Aggressively pursue watershed rules and regulations for public water supply wellhead areas.

- Maintain an adequate, balanced groundwater contamination response capability.

All agencies and interests should continue to implement recommendations of the Upstate Groundwater Management Program.

Chapter I. Introduction

Legislation

Preparation of a water resources management strategy is mandated by the Water Resources Management Strategy Act (Article 15, Title 29, New York State Environmental Conservation Law) of 1984. The law directs the state Department of Environmental Conservation (DEC), with participation of the state Department of Health (DOH) and regional planning and development boards, to precede the strategy with a statewide inventory of significant deficiencies in water systems and an assessment of local funding capabilities.

The law stipulates that the statewide strategy shall be composed of substate water resources management strategies which "recognize the natural boundaries of the water resources basins, watersheds, and aquifers and existing significant deficiencies of water supply." Thirteen substate regions were established for planning purposes (Figure 1). All the strategies address present water supply problems and future water supply needs with the goal of "(meeting) the water resources requirements of residential, agricultural, industrial and commercial users of these resources."

The law further provides for establishment of a 15-member Water Resources Planning Council within DEC. The council is required to receive the substate and statewide water resources management strategies from DEC, hold public hearings in each substate region and determine whether the strategy shall be "approved with modifications or disapproved." The approved strategies must be adopted by DEC and DOH and other appropriate state agencies in a form determined by the council. Finally, at least once every two years, the strategy must be reviewed and, if necessary, amended.

Objectives

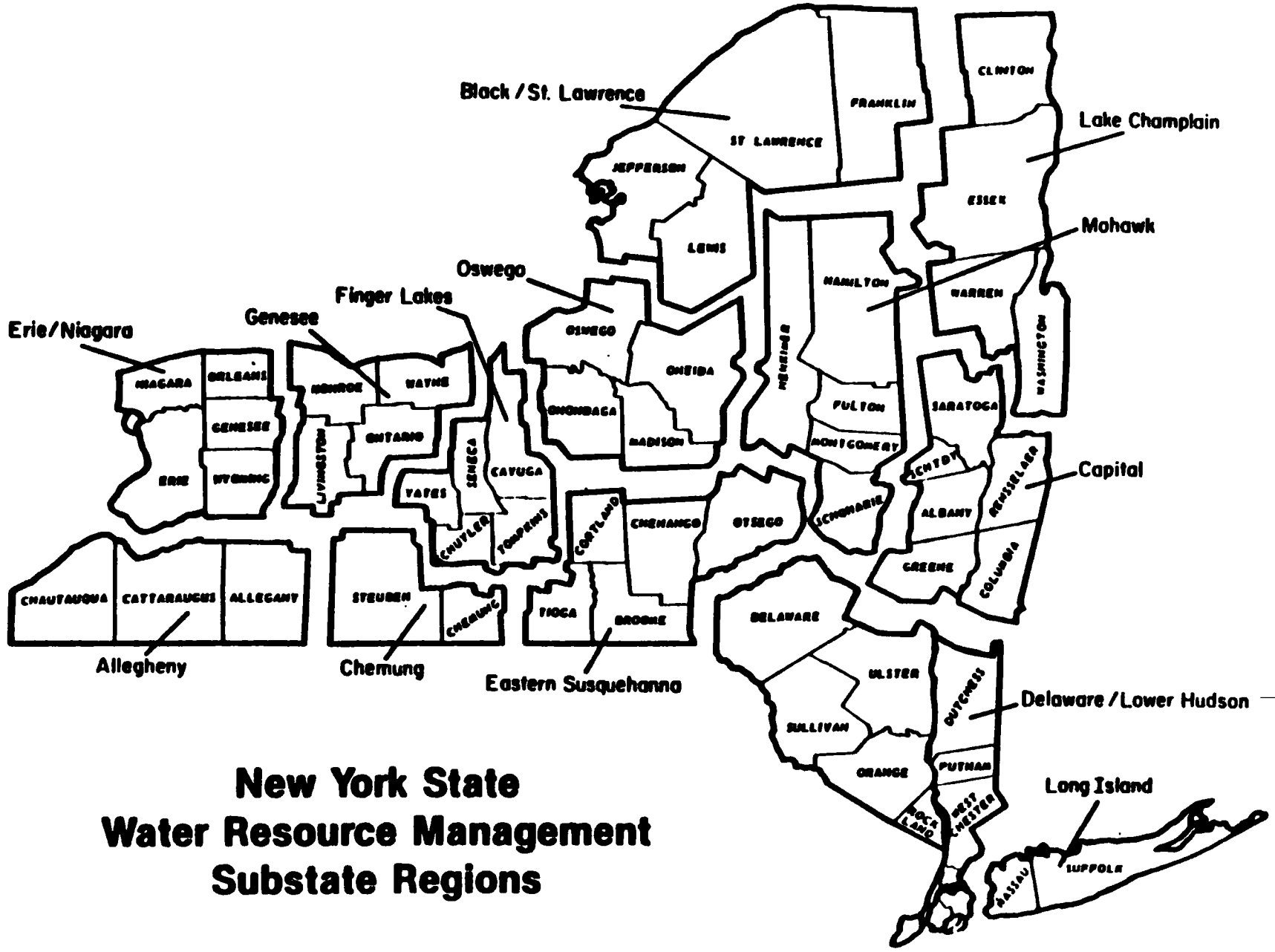
The broad overall objective of the state water resources management strategy is to meet the water resources requirements of residential, agricultural, industrial and commercial users and to assure the highest possible quality and quantity of New York State's water resources. Within this broad framework the strategy is designed to meet a number of other major criteria. These include:

- Providing quantities of water necessary for the requirements of residential, agricultural, industrial, institutional and commercial users while protecting environmental quality.

- Ensuring the delivery of a safe and aesthetically pleasing supply of drinking water to all residents of New York State and providing water of acceptable quality for agricultural, industrial, institutional and commercial uses while protecting environmental quality.

- Improving overall management of water supply systems to help ensure the optimum use of the water resources of the state.

- Encouraging the improvement, restoration and enhancement of water development and delivery from source to user.



New York State
Water Resource Management
Substate Regions

New York State
Department of Environmental Conservation

Figure I-1

- Fostering the development of means for research, data-gathering and management to facilitate informed decision-making.

- Ensuring and expediting adoption by appropriate state agencies, biennial review and implementation.

Procedure

DEC and DOH began preparation of the state water resources management strategy in 1985, and a draft was completed in 1987. The draft was based on information from the substate studies and strategies that had been completed or were in progress at the time and on other available studies and reports.

Common features of the substate studies and strategies were incorporated into the statewide strategy, which also addressed other water resources management issues of statewide concern that were not considered in the substate studies. Together, the state and substate strategies were conceived as a comprehensive set of actions recommended to meet statewide water resources management needs and to address regional and local system-specific problems and conditions.

Concurrent with preparation of the draft strategy, the Water Resources Planning Council considered criteria for the state and substate strategies and finalized the criteria in January 1987. The draft strategy could not satisfy all the criteria because of data gaps and other lack of information, and it was recognized that additional studies would be needed during the strategy updating process.

The Water Resources Planning Council requested DEC to hold public hearings on the draft state strategy and substate strategies to receive comments. One or more hearings were held in each of the 13 substate regions from July 1987 through April 1988. Many comments were received and have been taken into account in revising the draft.

The Water Resources Planning Council also undertook a detailed review and discussion of the draft state strategy by sections and the views of the Council members are reflected by numerous revisions in the draft.

Additional assistance in the state and substate strategies has been received from regional planning and development boards, local health departments and other local agencies, consultants, and water suppliers.

A. Available Water Resources

Water is a renewable resource that constantly circulates between the oceans, atmosphere and land in a natural process called the hydrologic cycle. Water evaporates into the atmosphere from the oceans and land and then condenses and falls back as rain or snow. Part of the precipitation flows over the land surface to streams and lakes and to the ocean. Another part enters the soil and is transpired by plants or becomes part of the groundwater system.

New York is rich in water throughout the hydrologic cycle, where it occurs as precipitation, surface water and groundwater . However, the state's water resources are not uniformly distributed, either temporally or geographically. Consequently, there are significant variations in available water supplies which in turn greatly affect water management and use. These variations are detailed in the following sections.

1. Climate and Precipitation

The climate of New York is humid-continental. Additional tempering influences of the Atlantic Ocean occur on Long Island and in southeastern New York, and of Lakes Erie and Ontario on their adjoining areas.

Under normal conditions, New York receives average annual precipitation of 40 inches with a range from about 30 inches along the western Lake Ontario shore and in the Lake Champlain valley to about 52 inches in the southern Catskills and southwestern Adirondack Mountains. The areal distribution of precipitation generally conforms to relief patterns and storm tracks across the state. Precipitation is fairly evenly distributed on a seasonal basis. The least amounts generally occur in January and February and the highest amounts may occur in several other months depending upon location. Statewide droughts are comparatively rare; the most extended and severe droughts have occurred in southeastern New York.

The state's average annual precipitation is equivalent to 91 billion gallons of water per day, or about 5,000 gallons per capita per day. Slightly less than half (43 billion gallons per day) is lost to the atmosphere through evapotranspiration. About a third (27-31 billion gallons per day) runs off into surface waters, and the remainder (14-18 billion gallons per day) seeps into and recharges groundwater resources.

2. Surface Water Resources

Surface water occurs in the many miles of rivers and streams and the large number of lakes, ponds and reservoirs in the state. These include:

- 70,000 miles of rivers and streams.
- 242 miles of rivers bordering other states and Canada.
- 3,100 miles of coastline.
- 7,500 lakes and ponds with at least 5,300 square miles of surface area.
- 1,477 square miles of marshes and wetlands.
- 22,164 billion gallons, or 68 million acre feet, of surface waters.
- 324 reservoirs.
- 4,074 billion gallons, or 12.5 million acre feet, of reservoir storage capacity.

About 10 percent of the state area is covered by surface water. Major rivers include the St. Lawrence, Hudson, Susquehanna, Oswego, Mohawk, Delaware, Black, Genesee and Allegheny. The largest interior lakes are Lake George, Chautauqua Lake, Oneida Lake and the major Finger Lakes: Canandaigua, Keuka, Skaneateles, Seneca and Cayuga. Freshwater supplies in the two Great Lakes, Erie and Ontario, and Lake Champlain are shared with other states and Canada. The Barge Canal system is a unique combination of streams, lakes and reservoirs tying together about 40 percent of the drainage area of the state.

Average annual runoff ranges from about 13 to 30 inches per year (Figure II-1). Almost half the annual runoff occurs during the three-month period from mid-February through mid-May. Water supply reservoirs depend on this spring runoff to sustain withdrawals during the summer and fall. Most of the time from July to the end of the growing season in October, streamflow is derived from groundwater.

Although there are large quantities of surface water stored in ponds, lakes and reservoirs and occurring in streams as runoff, only a portion of the total resource is available for water supply purposes. Utilization is limited by lack of reservoir storage capacity and withdrawal facilities, competing uses and other factors. The extent to which such limitations apply and specifically how much surface water is available for development and use are difficult to determine. Nevertheless, credible estimates of surface water availability are needed so that comparisons can be made with present and projected demands to identify resource problems and opportunities.

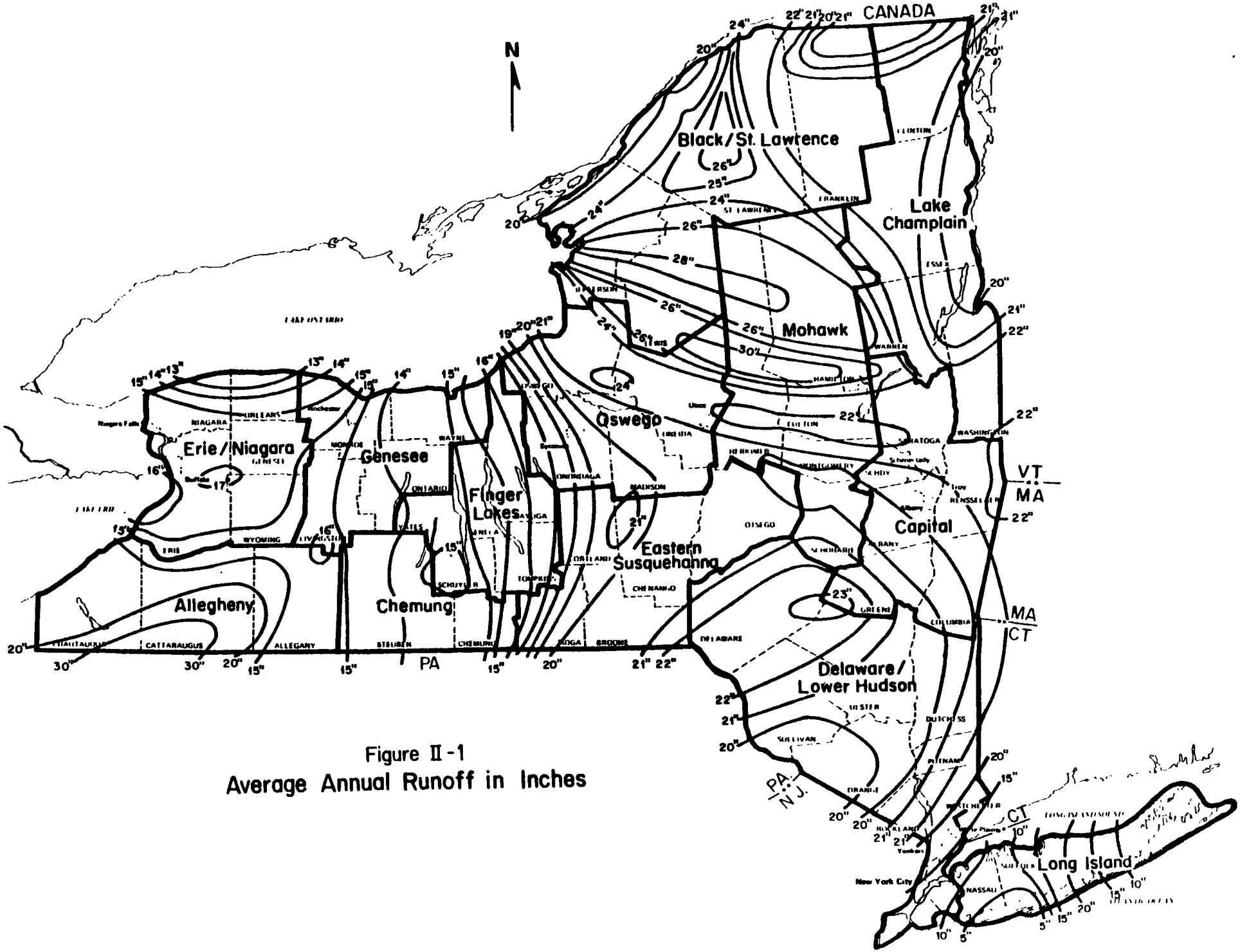


Figure II-1
Average Annual Runoff in Inches

Three streamflow characteristics are of particular importance for estimating available supplies. These are the lowest daily flow of record; the 7-day, 10-year low flow and the average discharge. The lowest daily flow of record is the lowest mean discharge in one day during the period of record. The 7-day, 10-year low flow is the lowest mean discharge during 7 consecutive days of a year occurring, on the average, once every 10 years. The 7-day, 10-year low flow varies from 0.03 to 7.0 inches (Figure II-2). The average discharge is the arithmetic average of annual average discharges for the period of record or analysis.

The lowest daily flow of record is used to define the dependable yield of the stream and should take into account existing uses. The 7-day, 10-year low flow is used as the criteria for wastewater treatment and represents the minimum flow required to meet instream flow needs for water quality. Additional flow is required in most streams for fish and wildlife and for recreation. The difference between the latter flow and average discharge is the portion of stream flow potentially available for water supply development. Runoff characteristics for all the substate regions are shown in Table II-1. The highest runoff occurs in the Black/St. Lawrence, Delaware/Lower Hudson, and Mohawk substate regions.

Water supply storage in the Great Lakes, Erie and Ontario, and Lake Champlain is virtually unlimited in terms of potential uses in New York. Other lakes and reservoirs, except those built specifically for water supply, may have drawdown constraints that limit use of the available storage. Useable storage and dependable yields must be determined on a case-by-case basis.

Surface resources provide drinking water to more than 10 million New York residents through public water supply systems. In addition, numerous industrial, commercial and agricultural operations are dependent upon surface waters.

3. Groundwater Resources

Groundwater is the water lying below the earth's surface in a saturated zone where all the interconnected openings between soil and rock particles are filled with water. The top of the saturated zone is called the water table and is usually located near the land surface. The saturated zone may extend downward to depths ranging from a few feet to several thousand feet, depending on underlying geologic formations. Land surface areas through which groundwater enters the earth are called recharge areas.

Groundwater moves very slowly through a complex network of spaces between grains of sand and silt, between particles of clay and along fractures in bedrock. It may appear in springs, discharge into surface streams, wetlands or the ocean, and it may be pumped from wells. Not all groundwater can be drawn readily into wells. The capacity of the soil to hold water (porosity) and to allow water movement (permeability) are the main characteristics which determine whether a geologic formation can supply adequate quantities of water. An aquifer is a formation that can supply water in significant amounts.

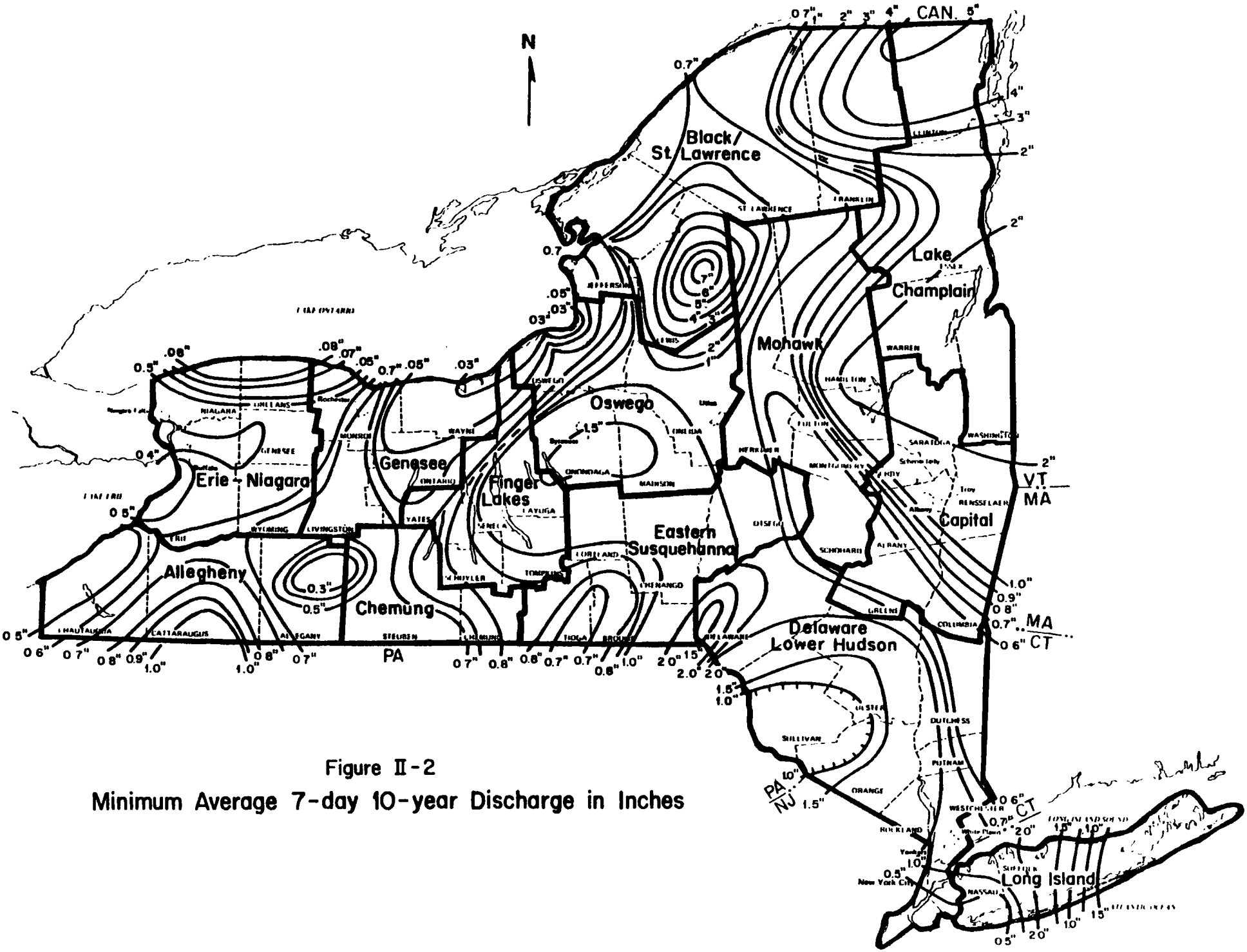


Figure II-2

Minimum Average 7-day 10-year Discharge in Inches

Table II-1. Runoff Characteristics for Substate Regions

Substate Region	Area SM	Annual Runoff CFS	Annual Runoff CFS/SM	7 Day, 10-Year Low Flow CFS	7 Day, 10-Year Low Flow CFS/SM
Allegheny	3,402	5,028	1.48	119	0.04
Black/St.Lawrence	6,926	11,694	1.69	1,000	0.14
Capital	3,481	4,660	1.34	126	0.04
Chemung	1,807	1,771	0.98	93	0.05
Delaware/Lower Hudson[1]	6,321	10,431	1.65	460	0.73
Eastern Susquehanna	3,631	5,664	1.56	214	0.06
Erie/Niagara	3,053	3,366	1.10	70	0.02
Finger Lakes	2,167	1,987	0.92	148	0.07
Genesee	2,545	2,375	0.93	21	0.01
Lake Champlain	4,567	7,183	1.57	747	0.16
Long Island	1,198	1,220	1.02	113	0.09
Mohawk	4,662	8,982	1.93	386	0.08
Oswego	3,613	5,524	1.53	141	0.04
Total	47,373	69,885	1.48	3,638	0.08
		(45,146 MCD)		(2,350 MCD)	

Abbreviations

SM = Square Miles
CFS = Cubic Feet Per Second
MCD = Million Gallons Per Day

[1] Including New York City (300 SM).

New York State soils vary greatly in their ability to hold and transmit water. Shale, limestone, sandstone or crystalline bedrock underlie the land surface and are covered by layers of soil varying widely in thickness. The bedrock generally has few open spaces and offers limited opportunity for water storage and movement. Clay soils can hold significant amounts of water because they have high porosity, but the water has difficulty getting out because of the low permeability. Glacial till, an unsorted mixture of soil and rock fragments, is common in upstate New York. Openings in the till for holding and transmitting water are limited.

Coarse sand and gravels are the best aquifer materials because of the large pore openings. The vast aquifer system underlying Long Island is the most important groundwater resource of this type in New York. Valley sand and gravel deposits in upstate areas also have large quantities of groundwater. Primary water supply aquifers and principal aquifers which have the potential for high yields are shown in Figure II-3. Aquifer and well characteristics for different types of aquifers are shown in Table II-2. About 11 percent of the state is underlain by sand and gravel aquifers capable of yielding significant amounts of water.

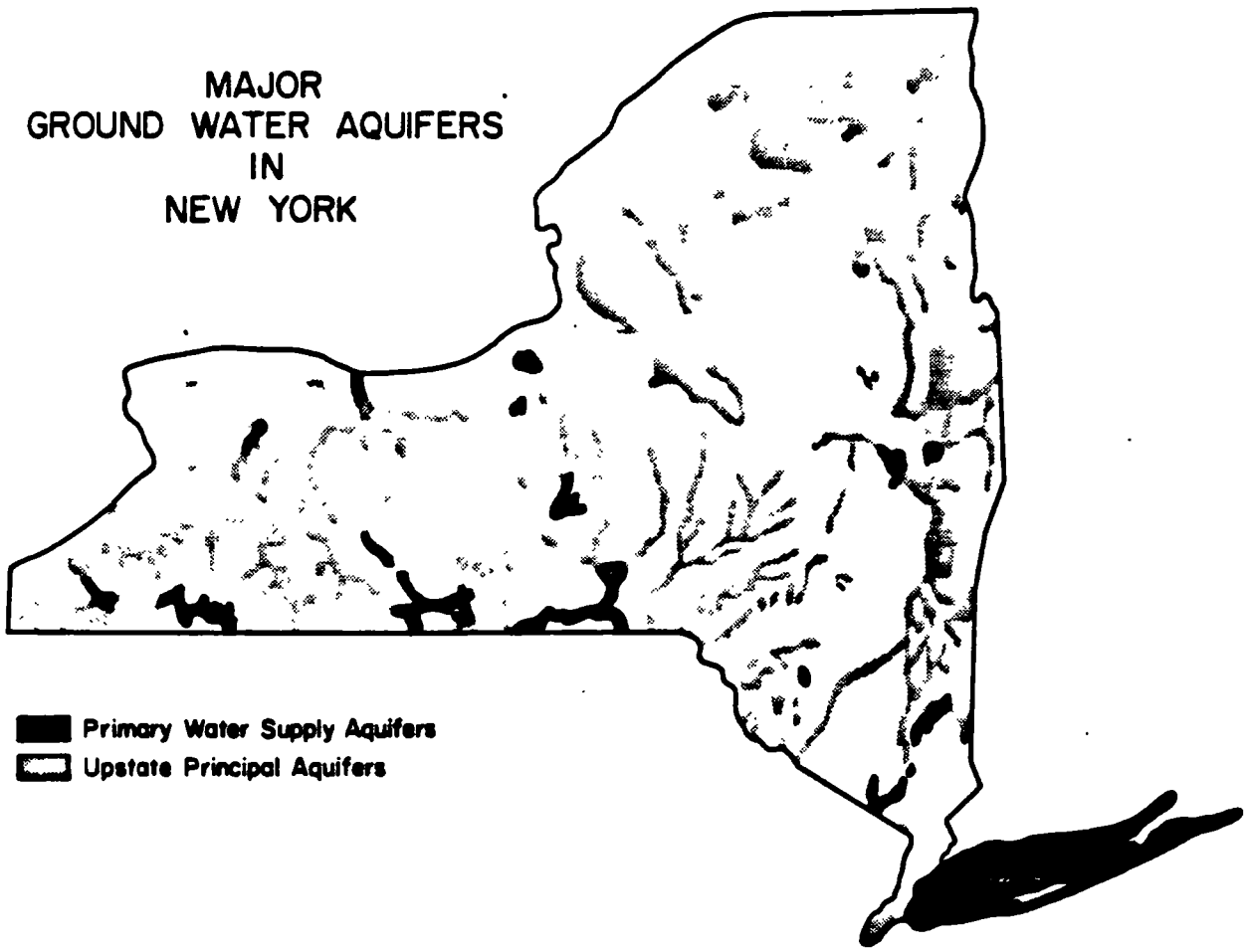
Eighteen upstate areas are designated as primary water supply aquifers and provide more than two-thirds of the groundwater used for community water supplies (Figure II-4). The other potentially high yielding, but less used, principal aquifers are considered important resources for the future.

More than 6 million New York residents obtain their drinking water from underground sources through public or individual systems. On Long Island alone, freshwater aquifers are the sole source of water supply for about 3 million people and for thousands of industrial, commercial and agricultural enterprises.

Although groundwater is present in large gross quantities, particularly in aquifers, only a portion can be developed for water supplies. Information is generally lacking on groundwater resource availability, except for certain aquifers and specific groundwater supplies. An estimate of the yield of primary and principal aquifers in the upstate area has been developed for the strategy (Table II-3). The total yield of the aquifers is estimated to be over 13 billion gallons per day; the highest yields are in the Black/St.Lawrence and Capital substate regions.

B. Water Use

Water is used and reused for many purposes. It is withdrawn or diverted from groundwater and surface water sources for public and individual supplies and for industrial, commercial, institutional and agricultural uses. Water use may also take place in streams, channels, lakes and reservoirs for purposes such as power generation, navigation, recreation, supplemental irrigation, water quality management, and fish and wildlife enhancement.



* Adapted from Heath Ground Water in New York, U.S. Geological Survey Bulletin GW-51, 1964.

Figure II-3

Table II-2

Aquifer and well characteristics in New York

[Ft = feet; gal/min = gallons per minute. Sources: Reports of the U.S. Geological Survey]

Aquifer name and description	Well characteristics			Remarks
	Depth (ft)	Yield (gal/min)		
	Common range	Common range	May exceed	
Upstate				
Stratified-drift-Lacustrine and ice-contact deposit aquifers: Sand and gravel. Unconfined.	10 - 300	10 - 50	100	In most areas, deposits consist entirely of sand. Excessive iron concentrations.
Valley-fill deposit aquifers: Sand and gravel. Generally confined.	3 - 200	100 - 1,000	3,000	Glacial outwash and alluvium interbedded with clay and silt in many valleys are most productive water-bearing material in New York. Locally excessive iron or manganese concentrations.
Carbonate-rock aquifers: Limestone, dolomite, and marble. Unconfined in most areas.	10 - 300	50 - 150	200	Carbonate rocks are most productive bedrock unit in State. Water from this unit usually hard and contains hydrogen sulfide gas in some areas. From Niagara Falls to vicinity of Syracuse and in St. Lawrence valley, deep wells yield slightly salty water and, in places, water with a sulfate concentration that may exceed 300 mg/L.
Sandstone aquifers: Includes both sandstone and conglomerate. Confined in most areas.	3 - 500	50 - 100	100	Sandstone is the second most productive bedrock unit in New York. Water commonly slightly hard and has excessive iron concentration locally.
Long Island				
Upper glacial aquifer (includes Jameco and Port Washington aquifers): Outwash deposits (mostly between and south of terminal moraines but also interlayered with till) consist of quartzose sand, fine to very coarse, and gravel, pebble to boulder sized. Unconfined.	50 - 500	50 - 1,000	1,500	Main source of drinking water in central and eastern Suffolk County. Contains high concentration of nitrates and organic compounds in western Long Island. Saline water problems in extreme eastern end of Long Island.
Magothy aquifer: Sand, fine to medium, clayey in part; interbedded with lenses and layers of coarse sand and sandy and solid clay. Gravel is common in basal 50 to 200 ft.	150 - 1,100	50 - 1,200	2,000	Supplies most of the ground water for public-supplied drinking water in Queens, Nassau, and western Suffolk Counties. Saline water in North and South Forks and near Jamaica Bay.
Lloyd aquifer: Sand, fine to coarse, and gravel, commonly with clayey matrix; some lenses and layers of solid and silty clay; locally contains thin lignite layers and iron concretions.	150 - 1,100	50 - 1,000	1,200	Main source of drinking water for northwest shore of Long Island barrier islands to south. Saline water in North and South Forks and extreme west end of barrier islands.

Source: National Water Summary 1984, Hydrologic Events, Selected Water Quality Trends and Ground-Water Resources, United States Geological Survey Water-Supply Paper 2275

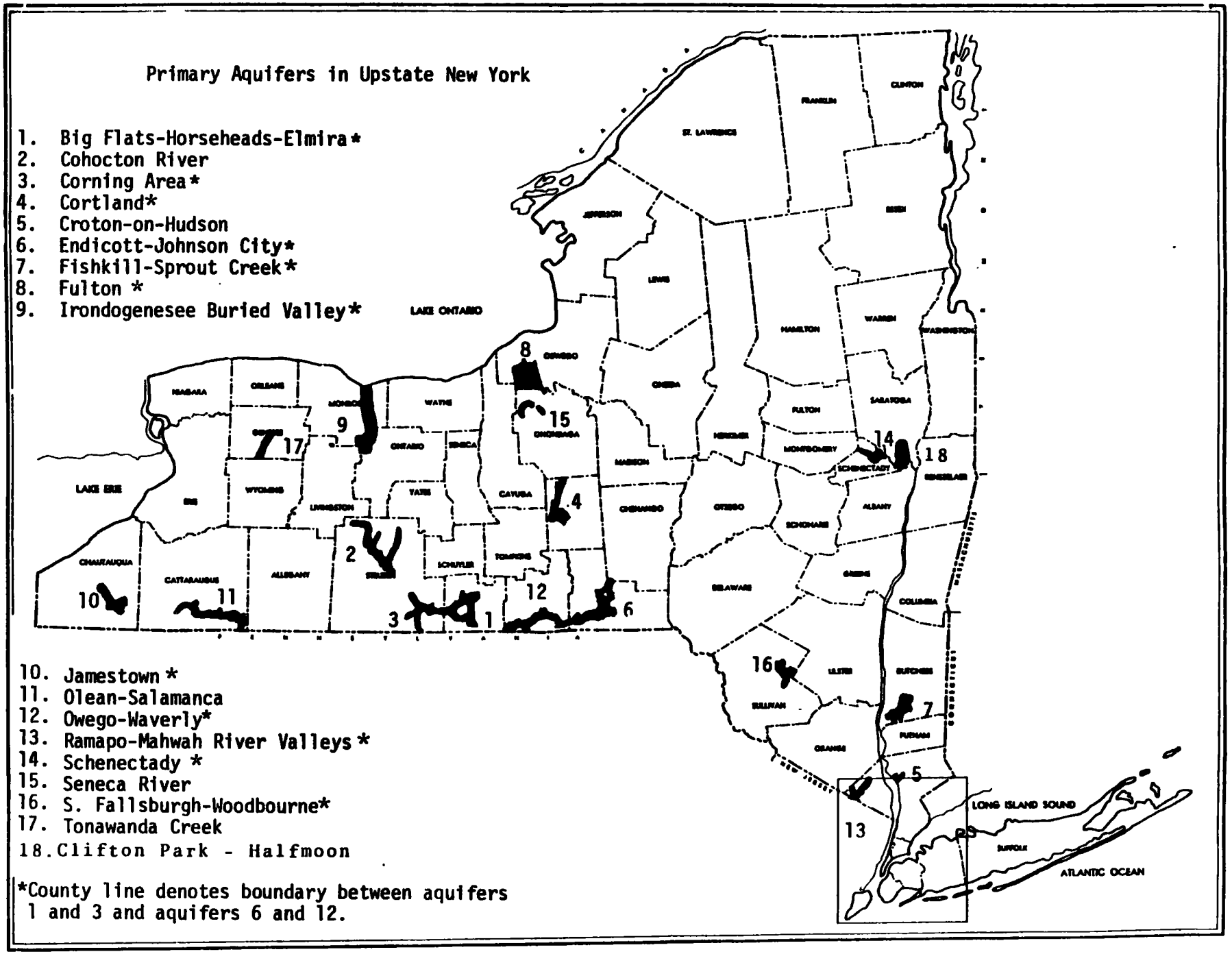

Primary Aquifers in Upstate New York
1. Big Flats-Horseheads-Elmira*
2. Cohocton River
3. Corning Area*
4. Cortland*
5. Croton-on-Hudson
6. Endicott-Johnson City*
7. Fishkill-Sprout Creek*
8. Fulton *
9. Irondogenesee Buried Valley*
10. Jamestown *
11. Olean-Salamanca
12. Owego-Waverly*
13. Ramapo-Mahwah River Valleys *
14. Schenectady *
15. Seneca River
16. S. Fallsburgh-Woodbourne*
17. Tonawanda Creek
18. Clifton Park - Halfmoon
*County line denotes boundary between aquifers 1 and 3 and aquifers 6 and 12.
LAKE ONTARIO
LAKE ERIE
LONG ISLAND SOUND
ATLANTIC OCEAN

Figure II-4

Table II-3. Yield of Primary and Principal Aquifers in Substate Regions, MGD

Substate Region	Primary Aquifers	Principal Aquifers	Total
Allegheny	512	792	1,304
Black/St. Lawrence	0	4,800	4,800
Capital	600	1,578	2,178
Chemung	470	330	800
Delaware/Lower Hudson	411	809	1,220
Eastern Susquehanna	588	666	1,254
Erie/Niagara	80	55	135
Finger Lakes	0	144	144
Genesee	108	176	284
Lake Champlain	0	490	490
Long Island	646[1]	0	646
Mohawk	0	106	106
Oswego	40	174	214
Total	3,455	10,120	13,575

[1] Dependable yield estimates for Nassau and Suffolk Counties from Long Island Groundwater Management Program

1. Public Water Supply

Public water supply refers to water withdrawn by public and investor-owned water suppliers and delivered to a variety of users for domestic or household use, public, industrial, institutional, and commercial use. Domestic use includes such activities as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens. Public use includes such activities as firefighting, street washing, and municipal parks and swimming pools. Many industrial and commercial establishments use public supplies, especially when the volume of water required is small and the quality of water must be high. Among commercial users are hotels, restaurants, laundry services, offices and institutions.

Public water supply is generally provided by a municipal water system, which is a public or investor-owned utility operated by a municipality, water district or authority, or by a private corporation, supplying water year-round. There are 1,799 municipal and investor-owned public water supply systems serving almost 16 million people in the state, or 87.7% of the population. The remaining 12.3% have individual supplies (Table II-4). About two-thirds of the municipal water supply is from surface water and one-third from groundwater (Table II-5).

Present water use data for municipal water systems were collected on a substate basis through surveys and inventories of all large water supply systems (over 5,000 people) and selected smaller systems. Future water requirements to the year 2000 were determined by using population projections and daily per capita water use estimates. Maximum day demands were calculated from the average day demands using peak flow to average flow ratios.

Total municipal water supply demands in the state were 3.9 billion gallons per day in 1985. More than 16 million people, or about 90 percent of the state's 1980 population, are served by 3,317 community water supplies, including nearly 1,800 municipal water systems. Water systems serving 5,000 people or more constitute more than 94 percent of the total municipal water demand in the state. However, systems under 5,000 constitute over 92 percent of the total number of public water systems.

2. Domestic Self-Supplied

Domestic self-supplied water use includes individual supplies for drinking water and a variety of household uses. Present and projected uses in this category were estimated on a substate basis by assuming that the number of people with self-supplied domestic water is represented by the difference between the population served by municipal water supply systems and the total population. It is also assumed that 60 gallons per capita per day is the average water use for domestic self-supplied.

TABLE II-4
NEW YORK STATE
MUNICIPAL AND INVESTOR OWNED PUBLIC WATER SUPPLY SYSTEMS

POPULATION RANGE	NO. OF SYSTEM	TOTAL POPULATION SERVED	% SERVED
Over 1,000,000	1	6,728,200	37.0
75,000-1,000,000	18	4,379,213	24.1
5,000-75,000	213	3,787,862	20.9
Under 5,000			
Surveyed	135	305,450	1.7
Not Surveyed	1,432	730,937	4.0
Sub Total	1,799	15,931,662	87.7
Individual Supply		1,822,338	12.3
State Total		17,754,000	100.0

TABLE II-5
SOURCES OF MUNICIPAL WATER SUPPLY

REGION	POPULATION IN MILLION	SOURCE OF SUPPLY: SURFACE WATER PERCENT	SOURCE OF SUPPLY: GROUNDWATER PERCENT
Upstate Counties	6.7	80	20
New York City	6.7	96	4
Long Island	2.4	1	99
Individual Wells	1.8	0	100
Total	17.6	67	33

About 2.3 million people statewide rely upon their own sources of supply for drinking water and other domestic uses. Virtually all individual supplies depend upon groundwater. The individually supplied population of Long Island and upstate are about 300,000 and 2,000,000, respectively. Approximately 138 million gallons per day (mgd) are used for individual supplies.

3. Large Self-Supplied Industrial, Commercial and Institutional

Many industries, commercial establishments and institutions require large amounts of water and have developed their own supplies. They may also use a public supply for principal or auxiliary water. Self-supplied water-using industries that ordinarily use large quantities include steel, chemical and allied products, paper and allied products, mining and petroleum refining.

There is little precise data available on industrial usage statewide or regionally for self-supplied firms. Neither is there quantitative information on water resource availability compiled to promote industrial water use. Industrial surveys have indicated that heavy emphasis is placed on water availability for site location decisions with this being the prime factor in 20 percent of cases.

Various prior studies and methods of obtaining data and making reliable estimates of self-supplied industrial use were considered in the substate strategy process. It was concluded that a thorough survey of each industrial facility is necessary for the best estimates. Since this was not possible within existing time and resource constraints, a more limited questionnaire-type survey was undertaken. Industrial facilities identified from various sources as possibly using large quantities of water (more than 20,000 gallons per day) were surveyed. The survey data and other available information were utilized to estimate present and projected industrial self-supplied use. Based on the above procedure and limited additional information, it was determined that about 2.2 billion gallons per day are withdrawn by self-supplied industries.

In some substate regions, water used by large self-supplied institutions was also estimated, based on available information. Commercial self-supplied use is believed to be insignificant.

4. Agricultural

Agricultural water use includes water used for irrigation of food crops and for livestock.

Agricultural irrigation in a humid state like New York is used to offset seasonally periodic rainfall deficiencies to sustain the yield of crops and reduce the risk of crop failures during drought periods. Generally, irrigation is used by producers of high value crops like vegetables and fruits to assure relatively consistent yields. Intermittent sprinkler irrigation is the most common method of supplemental irrigation in New York.

Data on irrigation water use are extremely limited and estimates are difficult to make because of the intermittent nature and the variable extent of areas irrigated from year to year. For the strategy, an estimating procedure was developed based on an historic relationship between growing season rainfall and irrigated acreage and rainwater available for irrigation.

According to the state Department of Agriculture and Markets, about 51,300 acres were irrigated in 1982 in the state. Water use for irrigation in 1982 was estimated to range from 7,300 million gallons to 11,000 million gallons. About 1,680 farms have some acreage which is irrigated. The trend in the past few years has been toward stabilization of the number of farms with irrigated acreage after an increase in the mid-70s. The largest irrigation water use is in the Long Island region.

Livestock water use includes direct consumption, as well as farm-cleaning activities and harvesting of livestock products. Since livestock water use is mostly by cattle and calves, estimates were made based on 1982 census data and a daily use rate of 20 gallons per livestock unit. On a statewide basis, livestock water use amounts to 35.6 mgd.

5. Other

Quantitive estimates of water use for other purposes, such as power generation, navigation and recreation, are beyond the scope of the strategy at this time and were not developed in the substate region studies. The following information is intended to give a general perspective. Implications of other water uses also may be inherent to some extent in the yield estimates for particular systems surveyed.

a. Power Generation

Water is used for power generation in thermoelectric power plants and hydroelectric plants.

Thermoelectric power plants can be powered by fossil fuel such as coal and oil, or by nuclear energy. Large quantities of water are withdrawn from both fresh and saline surface water sources in New York for thermoelectric power. Statewide withdrawals for this purpose were estimated by the United States Geological Survey (USGS) to be 12,000 mgd in 1980. Almost all the water is used on a "once through" basis for condenser and reactor cooling of generators.

Much larger quantities of water are used for hydroelectric power generation in New York. The USGS estimated that this use amounted to 310,000 mgd in 1980. Most plants are run-of-river. Only a very small quantity of water is lost through evaporation and quality is not affected usually.

b. Navigation

New York has over 525 miles of waterways within the state and hundreds of additional miles of border waters that are used for navigation.

The Barge Canal system links major watersheds across the state from Buffalo to Albany and Plattsburgh. Over 40 temporary and permanent dams have been constructed for pool maintenance purposes, and additional reservoirs are available for feeder supplies. Portions of the system are used for public water supply and industrial and agricultural supplies as noted in the substate strategies.

c. Habitat Uses

Fish and wildlife resources are owned by the state and are held in public trust for the use and enjoyment by the people. These organisms are legitimate users of the state's water resources, and many species are wholly dependent upon having adequate water of suitable quality for their survival and propagation.

Nearly all the surface waters of the state are classified according to best usage, and this water use as habitat is recognized in those classifications. All classified surface waters of the state at a minimum have "fish survival" as a designated usage, and perennial surface waters have both fish propagation and fish survival as designated uses.

Where these designated habitat uses are supported, minimum standards of quality and quantity must be maintained to prevent degradation and maintain attained uses. In those areas where the designated habitat use is impaired, improvement in water quality and quantity will be sought to end this use impairment, in conformance with the policies of the Water Resources Law and the federal Clean Water Act.

d. Recreation

New York has over 4,000 lakes, ponds and reservoirs that provide water-based recreational opportunities. In addition, there are thousands of miles of streams that provide recreational benefits. Water use for recreation is of major importance and is a significant factor in relation to water supply withdrawals.

C. Balance Between Supply and Demand

1. Statewide

The water supply-demand balance in the state is good, except in southeastern New York and localized upstate areas. With these exceptions, the state has adequate surface and groundwater resources to meet present and projected water supply needs to the year 2000 and beyond. Available resources also appear more than sufficient to meet needs to the year 2030. A number of water supply systems currently have excess capacity.

A preliminary comparison of available water resources with major categories of withdrawal use indicates that all the substate regions, except Erie-Niagara, have surplus water that is not being utilized (Table II-6). However, the Erie-Niagara region has access to Lake Erie, Lake Ontario and the Niagara River which are not included in the comparison.

Available resources could be developed to meet additional water supply needs and to stimulate economic growth. System evaluations in the substate studies indicate more specifically where surpluses or shortages exist and identify the potentials for new source development, interconnections, water conservation and other means for balancing supply with demand.

2. New York City Water Supply

The New York City water supply system experienced serious shortages in the 1960s record drought and more recently in the 1980-1981 and 1985 droughts. Water use restrictions were necessary to conserve the supply. Normal demand on the city system now exceeds dependable yield, based on the 1960's drought, by about 300 million gallons per day (mgd). Depending upon the projection of future water demand, recent deficit estimates to the year 2030 have ranged from 400 to 1200 mgd. Based on the Delaware/Lower Hudson Region study, the deficit for the city system is expected to be in the range of 300-800 mgd before the year 2030, even with conservation, but a more detailed study is under way to determine the water demands.

3. Long Island Groundwater

The vast aquifer which underlies Long Island, including all of Nassau and Suffolk Counties and parts of the Boroughs of Brooklyn and Queens in New York City, is the largest and most important groundwater resource in New York State. It is the only source of drinking water for more than 3 million people.

High demands on the aquifer have resulted in overpumping, stressing the system even though it contains large quantities of water. The aquifer also is particularly vulnerable to pollution from the overlying development and associated sources of contamination. Studies and programs to address the critical water resources management problems on Long Island have been underway for many years. Increased concern about the magnitude and complexity of the problems, particularly the threat of toxic pollution of the groundwater, led to a review of these programs and the resource management needs on Long Island in the early 1980's. This analysis resulted in preparation of the Long Island Groundwater Management Program in 1986. The program is a comprehensive set of recommended actions needed for effective management and protection of the aquifer system. They involve a large number of federal, state, and local agencies within an integrated overall framework.

4. Other Considerations

It should be noted that determinations of supply and demand and decisions on the need to increase supply or reduce demand by various means involve assumptions and judgments on a number of factors that cannot be determined precisely with available information.

Table II-6. Preliminary Estimate of Fresh Water Availability and Use by Regions, MGD

Substate Region	Gross Resource Average[1] Annual Runoff	Gross Resource Groundwater[2] Yield	Total	Waste[3] Assimilation	Minimum Fish and Wildlife[4] and Other Environmental	Water[5] Demands	Total[6]	Net Resource Available
Allegheny	3,248	1,304	4,552	77	1,701	64	1,842	2,710
Black/St. Lawrence	7,555	4,800	12,355	646	3,463	91	4,200	8,155
Capital	3,011	2,178	5,189	81	1,740	305	2,126	3,063
Chemung	1,144	800	1,944	60	904	51	1,015	929
Delaware/Lower Hudson	6,734	1,220	7,954	296	3,020	1,918	5,234	2,720
Eastern Susquehanna	3,659	1,254	4,913	138	1,816	73	2,027	2,886
Erie/Niagara	2,175	135	2,310	45	1,526	1,671	3,242	(-932)
Finger Lakes	1,284	144	1,428	96	1,084	59	1,239	189
Genesee	1,535	284	1,819	14	1,272	171	1,457	362
Lake Champlain	4,641	490	5,131	484	2,284	111	2,879	2,252
Long Island	788	6467	1,434	73	599	433	1,105	329
Mohawk	5,803	106	5,909	249	2,331	38	2,618	3,291
Oswego	3,569	214	3,783	91	1,806	267	2,164	1,619
Total	45,146	13,575	58,721	2,350	23,546	5,252	31,148	27,573

1 DEC estimate
2 DEC estimate for primary and principal aquifers.
3 7-day, 10-year low flow.
4 Gross estimate of 0.50 cfs/sm.
5 From Table III-4.
6 Does not take into account other uses for navigation, hydroelectric power generation and recreation.

a. Demand Projections

Projections of demand for public water supply systems can vary considerably based on differences or changes in population, economic growth and per capita water use. In the 1960s and early 1970s most water supply planning studies were based on highly optimistic projections of population growth and per capita use, resulting in gross over-estimates of long range water demands in the state. In some cases, high, medium and low ranges or projections were made in an effort to deal with this problem. Projecting water demands is most critical in the Delaware-Lower Hudson and Long Island substate regions. An intensive study is under way at present to develop a long-range projection of water demand for the New York City water supply system. Although it is recognized that other factors may affect water-demand projections, a uniform procedure based on population and per capita use was adopted for the strategy process. This method should be reasonably reliable for the time period to the year 2000. System studies are required for more detailed consideration of demand projections.

b. Water Conservation Effectiveness

Another factor affecting water demand projections is the influence of long-term water conservation measures. The effectiveness of water conservation was evaluated in the substate studies on a county basis using an available methodology. Determinations were made of the effectiveness of conservation programs that include such measures as leak detection and repair, conservation ordinances, public education, distribution of low-flow shower heads, toilet displacement devices, and commercial and industrial reuse and recycling. The results provide some guidance, but actual reductions in water demand that may be achieved vary from system to system and must be evaluated with site-specific data. Since the supply-demand balance is not critical in most of the state, the demand projections in the strategy do not include an allowance for effects of water conservation. Where there are supply-demand balance problems, such an allowance should be made.

c. Water Supply Yields

On the supply side there are similar uncertainties regarding water supply yields on a system basis. Definitions and interpretations of yield vary, even among professionals, and may be described by such terms as safe, dependable or reliable, each subject to specified conditions. The lack of a standard definition makes difficult the evaluation and comparison of system capabilities. In addition, many systems have no yield determinations by any definition that reflect the adequacy of supply. In the strategy process, common definitions of dependable yield were used for reservoirs and lakes, rivers and streams, wells and springs.

d. Drought Frequency and Acceptable Risk

Closely related to yield and adequacy of supply are questions of drought frequency and acceptable risk of water shortages. The frequency and severity of shortages that can be accepted in a water supply system are issues that have not been addressed to any significant extent, yet they are fundamental considerations in attempting to balance supply and demand. High priority should be given to research on this aspect of water supply.

Design of a water supply system is usually based on the drought of record. The probability of such a drought occurring again in any given year is problematic since frequencies of future droughts cannot be determined accurately with present analytical techniques. Thus, the reliability of systems can vary considerably depending upon the local drought experience during relatively short historic hydrologic periods. If the drought of record is a rare event, the system will have a low probability of water shortage and may, in fact, be over-designed. If the drought of record is a more frequent event, the system will be under-designed and have a higher probability of water shortage. No criteria have been established for drought probabilities to be used for water supply system design.

The risk of water shortages is closely associated with drought probabilities. All water supply systems have some degree of risk or shortage because of the high costs of no risk/no inconvenience/100 percent "safe" systems. Voluntary and mandatory water use restrictions must be included in any system management scenario to bridge the shortage periods. The problem is to determine an acceptable degree of risk and the public tolerance for individual, social and economic disruptions that result from water shortages. New York City has attempted to evaluate this factor by analyzing the frequency of drought warning and drought emergency periods under various assumptions for their period of record.

A strong research program is necessary to investigate these and other issues. They also should be considered in more detailed system analyses and in the decision-making process on specific actions relating to system improvement and management.

Chapter III. Major Statewide Water Resources Management Issues Discussion and Recommendations

The statewide Water Resources Management Strategy must respond to many issues related to water supply sources and systems. The major issues are discussed in this chapter, and recommendations are made for state and local actions. Some recommendations are based on the regional water resources management studies and strategies, for which data was collected on particular municipal water supply systems, agricultural users and self-supplied industries. Other recommendations are based on existing studies and program review.

The issues are grouped in six categories: water quantity; water quality; water supply system management; water supply system improvement; data and research; and public awareness, education and involvement. Discussions of these issues are based on comments received at public meetings, hearings, and on previous drafts of this document.

A. Water Quantity

A major goal of the water resources management strategy is to assure that the quantities of water necessary for residential, agricultural, industrial, institutional and commercial users are available while protecting environmental quality and public health. To meet this goal, a balance must be achieved between water demand and supply available, currently and in the future. The actions recommended in this chapter would ensure the development of improved water supply and water use information.

The section includes seven issues related to water quantity: 1. Water conservation; 2. New water supply source development; 3. Major water supply withdrawals; 4. Large diversions and consumptive uses; 5. Water supply regulation; 6. Instream flow management; and 7. Economic development.

1. OBJECTIVE: Conserve water; Waste none.

Water conservation has become increasingly important, even in water-rich New York, as greater water demand and contamination have placed more stress on existing resources. Restrictions on water use that are being imposed more often during relatively normal hydrologic periods illustrate the delicate balance between supply and demand for many water supply systems in the state. Clearly, long-term water conservation must be an integral part of water supply system management.

Long-Term Conservation Measures

Water conservation encompasses a broad array of measures and practices to preserve and protect water and avoid its waste. A permanent long-term water conservation program should include education, management, regulation and enforcement measures.

Educational programs should make water consumers aware of the true value of water, inform them about water waste and practices that avoid waste, and empower them to take steps to conserve water. Public education is also necessary to gain support for and understanding of management and regulatory programs. A water conservation education program could include preparation of newsletters, brochures, posters, public service announcements, exhibits and school curricula. Water utility bill inserts and annual water supply statements also are effective means of providing information on water conservation, management and quality issues. A wide variety of materials could be disseminated via direct mail, the news media, personal contact and special events.

Leak detection and repair are particularly important management approaches, because many water systems in the state have high percentages of unaccounted-for water. Substantial water savings could be achieved by locating and repairing the leaks in distribution systems and within buildings. Water pricing is another important issue for water utility customers. Various pricing mechanisms, such as summer/winter rates, encourage the conservation of water. The PSC has supported the use of higher summer rates to reduce peak summer water demand. Metering, water pressure reduction, and water auditing are among other topics on which management and educational programs can be based.

Water regulations may include water use restrictions, requirements for installation of water-saving plumbing fixtures, water-use reporting requirements, and imposition of water withdrawal limits in drought-vulnerable areas. The state low flow plumbing fixtures law (Chapter 516, Laws of 1979, as amended by Chapter 558 of the Laws of 1987) is a good example of a statewide regulatory activity. The law prohibits the sale, importation or installation of any plumbing fixture which is not certified to meet water saving standards, and requires that all faucets in public rest rooms be of a self-closing design.

A new state law, Chapter 364 of the Acts of 1988, amends the state water supply permit law (E.C.L. 5.15) to require all applications for a water supply permit to include a description of the applicant's water conservation program.

An effective long-term statewide water conservation program requires active participation by state and local governments, water suppliers and water users. The state's role is to establish policies, enact and enforce laws, promulgate rules and regulations, and implement programs that provide direction and assistance on the many aspects of water conservation. State-wide water conservation goals should be based on specific information for water supplies and should give priority consideration to special problem areas which have critical concerns regarding water supply-demand balance.

The role of county, town and municipal governments would be similar. Examples of local responsibilities include enactment and enforcement of codes and ordinances, information and education programs, development of water conservation plans for their jurisdictions, preparation of drought contingency and emergency plans, water use restrictions and enforcement of local water conservation programs.

The primary role of water suppliers would be to prepare water conservation plans and implement the many management measures that may be used to conserve water. For a large system a conservation plan should be a major element of the system management plan. This is a major responsibility, as the plan should establish a water conservation goal, and, at a minimum should include leak detection and repair, reduction of excessive pressures within the system, metering with fair and equitable water rates and regular meter maintenance, water rates that incorporate conservation incentives, public information on water conservation and other aspects of water supply important to consumers, emergency planning and assessment, reduction of unaccounted-for water and contingency measures. The water conservation program for a small system should be incorporated into the system operation plan. Conservation measures that are included in conservation plans must be evaluated for benefits, reliability, and economic, environmental and social costs.

Water users have the ultimate responsibility for long-term water conservation. They must support the actions of state and local governments and water suppliers and they must take individual actions to conserve water in their everyday lives.

Long-Term Conservation Benefits

Water conservation has significant long-term benefits. Analyses of the effectiveness of county-wide water conservation programs in the regional water resources management strategy studies indicate potential reductions in water use by the year 2000 of about 8% and 16%, respectively, for modest and moderate water conservation programs. Preliminary estimates of projected water savings from water conservation in New York City are estimated at 39 mgd in the year 2000 and 188 mgd by the year 2030.

Water supply systems benefit from the reduced water use and treatment costs, and so do sewer and septic systems, water consumers, and the environment. Water consumers benefit from reduced expenses in water heating and water and sewer bills. Wastewater systems save in energy costs, extended useful lives of facilities and improved on-site septic tank performance. Benefits to the environment include a broad range of possibilities, such as reduced occurrence of groundwater overdraft, improved reservoir appearance and quality due to reduced drawdown, increased streamflow, improved water quality due to more efficient sewage treatment, reduced percolation and overflow from septic systems and reduced leaching of lawn and garden chemicals.

The financial benefits of water conservation are indicated in a number of studies that have been made in other parts of the country. A 1981 study for the U.S. Department of Interior, Office of Water Research and Technology, investigated the costs and benefits of proposed water conservation projects in three communities around the nation and for a typical national case. Monetary benefits exceeded costs in all four cases, with consumers, water utilities and wastewater utilities receiving varying proportions of the benefits. The most significant consumer benefits from conserving water are in energy savings for water heating. The greatest potential savings for water and wastewater utilities result from deferred capital expansions.

Short-Term Conservation Measures

Water conservation also can be used as a short-term response to droughts and other water supply emergencies. Educational measures can increase public awareness of the water shortage and encourage actions to reduce water demand.

Sizable reductions in water demand may be achieved by these actions, even though demand usually returns to normal after the crisis is over. Water conservation on an intensified, short-term basis should be an essential element of drought contingency and emergency planning.

Recommendations

a. DEC should require each water supplier with a large system serving more than 5,000 people to prepare a water conservation plan as one element of their system management plan, which also should include a comprehensive emergency management plan. (See p. IV-28.)

b. DEC should require each water supplier with a small system serving less than 5,000 people to prepare a water conservation plan as a condition of each permit for an additional source of supply.

c. DEC, DOH and PSC should provide technical assistance to water suppliers on the preparation of water conservation plans, including development of model water conservation and emergency management plans and evaluations of specific water conservation measures.

d. DEC, DOH, and PSC should help water suppliers evaluate the benefits, reliability, and economic, environmental and social costs of water conservation measures in their conservation plans.

e. DEC should establish clear guidelines on how to calculate and document water conservation savings and should require each water supplier with a large system serving more than 5,000 people to report on such savings.

f. DEC and PSC should provide technical assistance to water suppliers on leakage control.

g. DOH, DEC and PSC should require large water suppliers to file reports with the state that identify safe yield, unaccounted-for water, consumptive use, drought vulnerability, per capita water use, and water use by type of customer; report annually to their customers on a range of water-related issues, including water conservation; and use billing formats that highlight water used over certain periods in comparison with previous years.

h. DEC should provide guidelines for large water suppliers to establish water conservation goals.

i. DEC and DOH should identify special problem areas that require particular attention for water conservation because of their critical balance between supply and demand.

j. DEC should evaluate modifications of the state low flow fixtures law, including more stringent standards, feasibility of a fixture-labelling requirement, adjustments to certification measures and additional enforcement procedures, including provisions for local enforcement. In addition, DEC should consider a retrofitting program.

k. A & M should establish an irrigation technology program devoted to water use efficiency and water quality safeguards for agricultural food producers and home and recreational turf management.

l. Office of General Services should conduct a feasibility study on retrofitting water-saving plumbing fixtures in state facilities.

m. DEC and DOH should establish and maintain comprehensive public information and education programs on water conservation, including preparation and distribution of informational materials and other means to encourage water conservation.

n. DEC and DED should assist businesses, industries and institutions to reduce their water use by collecting, maintaining and disseminating technical information on water saving methods, such as equipment changes and recycling and reuse of process water, and by continuing to promote water audits, particularly for large industrial water users.

o. Local governments should develop and establish comprehensive water conservation programs for their jurisdictions (county, town, city, village). Possible measures include:

i. Distributing water conservation materials.
ii. Conserving water used for public purposes.
iii. Retrofitting plumbing fixtures in government facilities.
iv. Promoting plumbing fixtures in residences.
v. Incorporating the state plumbing fixtures law into local codes.
vi. Making local plumbing codes more restrictive than the state law.
vii. Putting limitations on the size of turf planted areas (lawns) which may utilize irrigation.
viii. Establishing a clear process for enforcement of local water conservation programs.
ix. Establishing effective controls over stolen water and unauthorized water use.
x. Imposing water use restrictions during droughts and other water supply emergencies.

2. OBJECTIVE: Assure that alternatives are considered before developing any new water supply source.

Historically, new water supply sources have been developed to meet increased water demands in the state without considering whether existing supplies could be used more efficiently or if other alternatives were available. The policies, criteria and guidelines followed since 1905 by DEC and predecessor agencies in administering the state's public water supply permit program generally have allowed new source developments to be made without major constraints. System managers have focused on developing additional sources to keep pace with increased demand.

Now there is greater recognition of the need to reassess some proposed new water supply source development projects. Water resources, although generally abundant on a statewide basis, are limited in quantity or quality in certain areas and must be safeguarded from overdevelopment to ensure that present and future water needs can be met adequately. The environment must be protected to the extent possible from adverse impacts of new source development that must be mitigated. Water users must be made aware that economic hardships that may result from potentially higher costs of developing new sources are unavoidable.

Demand may be reduced by using water conservation measures, existing facilities may be adjusted or expanded to remove constraints on the delivery system and systems may be interconnected. A state requirement that these alternatives be fully considered before new source development is permitted would help safeguard the state's water resources by ensuring that the most feasible and desirable actions are taken to meet water demands.

New sources of supply will need to be developed for some systems. It is not an appropriate role for the state to actively block water-using development in localities. Some systems may have operational characteristics that preclude certain options, and several systems have surplus water that can be developed readily for beneficial economic uses and to satisfy additional water demands. Where found necessary, new source development should proceed on a timely basis. It is appropriate for the state, however, to promote economic development based on available water supplies and to ensure that new development is consistent with other resource management objectives, including the ensurance of sustainable quantities of water for the ongoing needs of present public supply systems and self-supplied users.

Recommendation

DEC should modify the state public water supply permit program to require water suppliers seeking to develop new sources to demonstrate that they:

- have effective water conservation programs in place to reduce water demands;

- are using existing sources as efficiently as feasible for their operations;

- have made any feasible facility adjustments or expansions for the efficient delivery of water from existing sources;

- will not place in jeopardy the other existing public or self-supplied services already provided by a portion of any new or expanded sources; and

- have identified all existing and potential water supply sources.

3. OBJECTIVE: Obtain information on large withdrawals of water for all purposes.

Water resources management is seriously handicapped by the lack of comprehensive data on water use. Although information is available on public water supply use in the state as a result of DEC permit and DOH and PSC reporting requirements, information on other major water uses is lacking because state permits and reports are not required for them. More complete information is needed on large withdrawals to better understand how much water actually is used and where it is used, and to protect sources from overuse. Water surplus and deficit areas should be identified to determine the potential for new source development and to guide broader decisions

on water supply, resource management, environmental protection and economic development.

The most expedient way of obtaining the needed information is to require registration of water use with the state. Registration involves the recording of water use, and is not a process for obtaining water use permits. The registration requirement would apply only to large water uses that are above a base yet to be established. Small water uses, such as individual domestic and ordinary farmstead uses, would not be registered. Information on these uses would be obtained by surveys or other methods.

This water use information is also needed to comply with the Great Lakes Charter, which was approved by New York State in 1985. The Charter requires the collection of water use data for all withdrawals in the basin exceeding 100,000 gallons per day average for any 30-day period. This is essential to the Charter's further requirement of implementing of a regulatory authority, such as a permit program, for withdrawals or diversions in excess of 2,000,000 gpd. Compliance with these requirements is necessary to participate in consultation procedures applying to any new or increased diversion or consumptive use of the waters of the Great Lakes Basin in excess of 5,000,000 gpd. New York must implement procedures to uphold its rights under the Charter in order to protect navigation, hydroelectric development and shoreline ecology. State legislation that would satisfy the Charter requirement has been introduced and is being considered at this time.

Recommendation

The state should enact legislation requiring registration with DEC of any withdrawal of water exceeding 100,000 gallons per day during any 30-day period anywhere in the state.

4. OBJECTIVE: Control large diversions and consumptive uses of water.

Large quantities of water are transported from one major river basin to another within the state for public water supply and other purposes. Substantial diversions for navigation are made through the state barge canal system, which receives runoff from about 40% of the state's drainage area and crosses five major river basins. The largest diversions for public water supply are from the Delaware River Basin into the Hudson River Basin for the New York City system.

Diversions within the state are of interstate concern, also. New York City's diversions from the Delaware River Basin are of particular concern to New Jersey, Pennsylvania and Delaware and have been subject to litigation which resulted in a U.S. Supreme Court Decree in 1931 and Amended Decree in 1954, which specifies maximum diversions and minimum releases from the New York City reservoirs. More recently the concerns were manifested in intensive negotiations

among the decree parties over a period of several years, culminating in a 1983 interstate agreement on water management recommendations for the Delaware River Basin.

Diversions from the Great Lakes Basin, which encompasses 30% of New York State, are of particular concern to the eight basin states and two Canadian provinces because of the potential for large-scale diversions to other parts of the country. Similarly, consumptive water uses are a major issue in the Great lakes Basin where they are projected to increase substantially in the future to meet in-basin water needs. Water that is used consumptively is the most critical part of the total withdrawal because it is not returned to the source. Consumptive uses are difficult to quantify but for most public water supply systems they are on the order of 10-15%. Other consumptive uses occur by evaporation and by incorporation of water into manufactured products or agricultural crops. Diversions also are a form of consumptive use. Large diversions and consumptive uses of water have major potential for adversely impacting water and related resources.

Recommendation

The state should enact legislation establishing a DEC permit program to control large diversions and consumptive uses (more than two million gallons per day) from all New York drainage basins.

5. OBJECTIVE: Determine whether additional water use regulation is necessary to manage water resources effectively for uses other than public water supply.

As water demands continue to increase there is growing concern about whether surface and groundwater resources can be managed effectively and future use conflicts avoided without state regulation of all major water withdrawals.

The present public water supply permit requirement was established by statute in 1905 because of statewide public health concerns about water supply and southeastern New York concerns about extension of the New York City water supply system into upstate watersheds. The law was subsequently modified in 1911 and 1973.

Permits are issued by DEC subject to DOH review and approval of water treatment provisions. DEC currently must make the following seven statutory determinations.

1. The plans proposed by the application are justified by public necessity.

2. The plans take proper consideration of other sources of supply which are or may become available.

3. The plans provide for proper and safe construction of all work connected therewith.

4. The plans provide for the proper sanitary control of the watershed and proper protection of the supply.

5. The plans provide for an adequate supply.

6. The plans are just and equitable to the other municipal corporations and civil divisions of the state affected thereby and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

7. The plans make fair and equitable provisions for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the acquisition of said lands or the execution of said plans.

In 1933 the program was expanded significantly by a statute requiring regulation of large wells on Long Island used for all purposes except agriculture and fire fighting. Large wells are those with over 45 gallons per minute of installed pump capacity. Registration of well drillers and filing of well logs has been required on Long Island since 1972.

Water works corporations, which are regulated by PSC, also are required to have water supply permits from DEC.

Legislation that would give DEC-issued certificates of entitlement to water resources would clarify rights of water-users and help establish water use priorities. It also would help protect the investments of citizens, industries, farms and businesses in water production and water-using equipment, ensure the optimum use and development of water for economic and environmental purposes, and control unnecessary depletion of water resources through mandated review of all proposed significant uses. The entitlement proposal requires thoughtful consideration since it involves a fundamental change in the state's existing water use doctrine.

Recommendation

DEC should conduct a study to evaluate the need to establish permit programs or other allocation system for uses in addition to public water supply.

6. OBJECTIVE: Balance competing uses of streamflow.

New York has an extensive network of rivers and streams, totalling about 70,000 miles. Streamflow is vitally important for instream water uses, as well as for withdrawal purposes. Development of New York's rivers and streams for the transportation of goods and the generation of electricity and power has provided a strong foundation for the state's continued economic development. For example, hydropower production provides New York with over 3,000 megawatts of

clean electric generating capacity. Additionally, the value of instream flows for the protection and enhancement of fish and wildlife resources, for recreational uses, for aesthetic purposes and to meet water quality objectives are also important public policy considerations which must be adequately balanced with increased development.

The public policy objective of instream flow management is to balance competing water uses to the extent possible to minimize adverse impacts and achieve the greatest benefits from New York's rivers, reservoirs and streams. Dams and reservoirs are important tools for managing streamflow. Without the water storage they provide, low streamflow cannot be augmented nor can high flows be reduced.

Withdrawing water directly competes with instream uses, however, since stream flow is depleted by the withdrawals. When dams and reservoirs are constructed and operated to provide greater withdrawals, instream water use can be impaired more severely. In some cases, such as public water supply, a high percentage of the water withdrawn is used non-consumptively and returned to the stream.

Instream water uses also can compete with other water uses. For example, older hydroelectric facilities which store and release water to meet fluctuating demand for electricity cause stream flow and reservoir levels to fluctuate,, which has an environmental impact on fish and wildlife and recreational use. Over the past 10 years state and federal hydropower review and approval of new generating facilities has largely ensured that only "run of River" facilities are constructed and operated where appropriate. Additionally, as a condition of issuing environmental permits, DEC has required that minimum instream flows be maintained, that fish ladders be provided where necessary, and that recreational access be enhanced. Generally speaking, instream uses are complementary to each other, and the same flow that benefits fish and wildlife resources can be used for recreational purposes, to help meet water quality objectives and to improve aesthetic conditions.

New York has many existing dams and reservoirs. Settlement of the state was accompanied by the construction of more than 6,000 dams for public water supply, power generation, industrial and commercial uses, navigation, flood control, agriculture, recreation and other purposes. These dams and the reservoirs created by them have altered to some degree most of the major streams and valleys in the state.

Negative Impacts

Placement and operation of the dams and reservoirs interrupted the original river continuum and altered flow regimes, water quality and aquatic ecosystems. Dams are barriers to the movement of many aquatic species, seriously affecting those that migrate during part

of their life cycle. Where dams are accompanied by diversions, many miles of downstream streambed may suffer significant flow reductions or are dry for part of the year. These streams consequently support only a fraction of the living resources they once did. Diminished instream flows often reduce downstream water quality (especially the maximum temperature and minimum dissolved oxygen), decrease the stream's capacity to recover from pollution, reduce the physical amount of habitat available to entire biological communities, and reduce the opportunities for use by other riparian landowners. When water is diverted and then returned to lakes and streams, it frequently has been altered in some way, such as by being warmed, enriched with nutrients, polluted with contaminants or depleted of oxygen.

Some dams and other impoundments replaced swift-flowing stream habitats with slower-flowing deep water habitat. Operation of the impoundment may cause wide seasonal fluctuations in water levels, which may adversely affect recreational uses and life at the water's edge, in the littoral zone, and the presence and quality of the hypolimnetic zone. Drawdowns may cause the death of some fish and wildlife and hamper their capability for their reproduction.

Positive Impacts

Water developments also have produced many direct benefits. They may provide clean energy, drinking water and recreational opportunities, and they may have beneficial effects on environmental resources within reservoirs and in downstream areas. For example, recreational opportunities are provided by lakes and reservoirs and by releases from them in conjunction with operations for power generation, water supply, navigation and flood control. Fish and wildlife resources have benefited from the construction or expansion of impoundments which have created habitat for species that thrive in a lake environment. Cold water ecosystems have even been created where they did not exist before, both in the impoundment proper, and in waters receiving deep water discharges from impoundments that thermally stratify. On many streams water quality and aesthetics are enhanced by reservoir operations.

With increased public policy awareness and regulatory authority, many of the environmental problems encountered in the past with single purpose development can be balanced and mitigated without jeopardizing environmental quality, recreational access or conflicting with the state priority of water use for domestic and municipal purposes. New York's water resource strategies must strive to preserve regulatory balance and perspective.

Detailed analyses of the operation of individual reservoirs and reservoir systems with the state, particularly in the Delaware and Hudson River Basins, recently have demonstrated that changes can be made to meet multi-purpose objectives for reservoir use and instream flow management. A comprehensive, focused state effort is needed to investigate the many additional opportunities that are available to improve stream flows to protect and enhance instream uses and

environmental resource values and to obtain the related socioeconomic benefits.

Recommendations

a. The state should adopt a policy stating that stream flows in all streams, from source to mouth, shall be sufficient to balance the protection of natural resources, as well as to maintain adequate water quantity, quality, assimilative capacity, recreation, agriculture, transportation and power generation uses, while recognizing domestic water supply has the priority use of the state's water resources. This minimum flow policy would apply to all new impoundments, diversions and withdrawals, including withdrawals from primary and principal aquifers.

b. DEC should develop criteria for minimum flows to be applied to all waters of the State, based on natural stream hydrology with existing streams and river conditions.

c. DEC, in cooperation with other interested state agencies, authorities and public interest groups, should review the operation of all existing impoundments (meeting the thresholds of ECL 15-0503) to identify problems and opportunities to balance competing water uses through instream flow management while not significantly impairing the intended purpose of the impoundment. Such an evaluation may include but should not be limited to analyzing the impacts on aquatic resources within the impoundment as well as downstream of the impoundment.

d. DEC should recommend ways to minimize impacts of existing structures and impoundments on fish and wildlife resources and other instream uses. For existing impoundments with release control structures, recommendations should include regulation of the volume of water, rate and timing of release and the rate of change in release of the water.

e. DEC should investigate the need for instream releases from existing facilities and propose new statutes for obtaining minimum releases if necessary, consistent with overall water resource needs.

f. DEC should require that new water intake structures be designed to minimize impingement and entrainment impacts to aquatic organisms and populations, and that impacts of existing structures be reviewed during the license or permit renewal process and changed, if necessary.

g. DEC should review new dams, withdrawals and diversions, as well as requests to modify existing permits, in light of resource management needs and competing uses, and should explore and

implement alternatives to the greatest extent possible to minimize environmental impacts.

7. OBJECTIVE: Benefit economically from using available excess water.

New York's economic development is dependent upon the availability of adequate water supplies. Much of the state has surplus water that can be developed readily for beneficial economic uses. However, the development must be consistent with other resource management objectives, such as the safeguarding of agricultural land resources for food production and the protection of environmental resources. Also, heavy water-using development could create environmental and economic problems in areas of the state that lack surplus supplies.

Municipal supply systems that already have excess capacity could help satisfy additional water demands in adjacent systems where yields are exceeded. In doing so, these water suppliers can increase their revenues while promoting the beneficial use of their excess capacity.

Recommendations

a. DED and DEC should help municipalities use their available excess water supply capacity to promote economic development which takes advantage of available water supplies, and should guide water-intensive development toward areas with readily available supplies, without inhibiting other land-related resource management objectives.

b. Localities should consider the availability of water when making local land use and economic development decisions.

B. Water Quality

Although water quantity is the major focus of the Water Resources Management Strategy, quality is a fundamental consideration in the management of the state's water resources. The overall quality of surface and groundwater resources in the state is good, but the quality has been impaired by human activities and major efforts are required to restore specific waters to meet the state's goal of non-degradation for their best use, especially where a best use is for drinking water.

The close interrelationship of quality to quantity is well established for certain water uses, such as industrial, recreational and public water supplies. Quality characteristics may limit the availability of supplies for use, and, conversely, water use may impact quality, such as on Long Island where groundwater over-pumping could cause saltwater contamination of the aquifer. Water quality problems significantly increase treatment and costs of meeting drinking water standards for public water supply systems. Quality is also a constant concern for individual well supplies.

The State Pollution Discharge Elimination System (SPDES) administered by DEC is the basic water quality program in the State. Under SPDES the Department issues permits limiting some 2,800 direct discharges to rivers, lakes, and streams. Over 500 of these discharges include toxics. The receiving water is a pre-eminent consideration in the control of water pollution. Each SPDES permit contains a unique set of requirements designed to prevent pollution from interfering with the best use of a specific receiving water. The best use is expressed in a classification assigned in state regulations, such as Class A for drinking water. Associated with each water quality class is a set of standards specifying chemical and physical conditions which must be met to keep the water usable as classified.

Originally, water quality standards covered conventional pollutants and a few inorganics (mostly metals). In the past five years New York has established water quality standards for 95 toxic pollutants and has prepared numerical criteria for an additional 100 toxics. DEC uses these standards and criteria to determine permit limits. A program is maintained to monitor discharges and achieve compliance, and stringent civil and criminal penalties may be imposed for illegal discharges.

The SPDES and other water quality-related programs have produced significant improvement in surface water quality. About 76% of the streams and 60% of the lakes, reservoirs and ponds in the state now fully support their designated uses. Nearly all of Lake Erie's waters support their designated uses, although Lake Ontario's ecosystem continues to be impacted by mirex contamination. Problems caused by point sources of pollution have decreased, and nonpoint sources now are the most predominant cause of impaired use. Agricultural and urban runoff are the most significant contributors.

Other much-needed water quality management programs directly related to water supply would control the releases of hazardous substances that are not wastes, implement the Upstate and Long Island Groundwater Management Programs, clean-up PCB's in the Hudson River, take additional actions on emissions that contribute to acid rain, and carry out special quality programs relating to the Great Lakes.

Three water quality issues that relate specifically to water supply are discussed in this section. They are (1) Protection and preservation of water supply sources, including watershed rules and regulations, land use controls and groundwater protection; (2) Surface water treatment; and (3) Groundwater treatment.

1. OBJECTIVE: Protect and preserve water supply sources.

   There are concerns in almost every region about existing or potential contamination of surface and groundwater sources.

   The most critical surface water quality problems in the state are those associated with high levels of nutrients, oxygen demand, bacteria, toxics, sediments or minerals, and oil or hazardous substances. About 345 river miles and 131,000 lake acres are affected by toxic pollutants. Contaminated sediments cause

virtually all of this impairment, and together with nonpoint sources they comprise the major source of surface water use impairment in the state.

Groundwater quality problems are related directly to land activities. Groundwater contamination may be the result of outdated or otherwise ineffective industrial and municipal landfills, on-lot disposal systems and percolation from inefficient application of chemicals. The most serious groundwater contamination is on Long Island where almost 5% of the major public drinking water wells are closed or restricted in their use because of contamination from synthetic organic chemicals, nitrates, pesticides and salt water. Many private wells are similarly contaminated. In upstate New York, organic contamination has caused the closing of 50 community water system sources, mostly wells. Other major upstate concerns include groundwater contamination in both public and private wells from drilling and gas extraction in the Allegheny Region and contamination of primary aquifers in other regions. Areas with specific quality problems are listed in Table III-7.

The protection of water supply sources from contamination has long been recognized as necessary to safeguard the public from water-borne disease. Source protection is an essential element of the state's multiple barrier approach to providing safe water supplies. The first step is prevention through water pollution control efforts, the second step is protection through water supply-related activities, and the third step is water treatment.

State water pollution control laws, watershed rules and regulations, watershed acquisition and local land use controls, including zoning, site plan review and local subdivision controls, are the most effective tools for protecting the quality of surface and groundwater supplies. The state water pollution control program should be carried out vigorously to protect and improve the quality of both surface and groundwater sources of supply. Watershed rules and regulations, watershed acquisition and local land use controls should be used to limit the extent and type of activities taking place over critical aquifers and their recharge zones. All wastewater discharges into known tributaries to drinking water sources should be disinfected, in keeping with good public health practices and the multiple barrier protection concept.

These tools have not been used to protect and improve water quality to the extent that they should be. The water pollution control program is hampered by lack of administrative staff, technical tools and enforcement actions. Watershed rules and regulations have not been kept up-to-date, and implementation of program changes has been constrained by other water quality priorities. There has been little incentive for local land use controls. About 10% of the state's major industrial and municipal wastewater treatment facilities are not in compliance with their discharge permit requirements.

Watershed Rules and Regulations

DOH promulgates watershed rules and regulations under Public Health Law Article 1100 for the protection of any or all public water supplies upon the request of water suppliers, except for New York City which is empowered to enact them subject to approval of DOH. Specific provisions in the rules and regulations can cover a wide variety of activities on the watershed that may threaten the quality of the drinking water supply. For groundwater sources, existing watershed rules and regulations limit specific activities and prohibit locating potential sources of contamination within specific distances of the wells. They may also protect aquifer recharge areas.

The Watershed Rules and Regulations Program has been given low priority at the state level. Rules and regulations now apply to 256 municipal sources (150 surface, 91 groundwater and 15 mixed surface and ground), only about 23% of the 1,095 sources statewide. Most of the sources serving large populations are covered by rules and regulations, so most of the state's population receives drinking water from sources with this protection. But many of the rules and regulations are out of date and in need of revision, and enforcement at the local level is a problem.

The Safe Drinking Water Act Amendments of 1986 recognize the importance of protecting wellhead areas for public water supply systems relying on groundwater supplies. Each state could submit a program to EPA by June 1989 that outlines the roles of state, local and public water supply agencies, determines wellhead protection areas for each well or wellfield, identifies potential contamination sources and describes a protection plan and contingency plans. States that submit programs may be eligible for grants to develop and implement their program. DEC is developing the Wellhead Protection Program for New York in cooperation with federal, state and local agencies.

Land Use Controls

Local land use controls are among the most important mechanisms available to manage surface and groundwater resources effectively. Land use is a basic determinant of potential groundwater contamination as well as of groundwater use.

Zoning is the basic control by which the actual use of land may be prescribed and by which the diversity and intensity of use may be controlled. In New York State the power to zone has been delegated to the governments of cities, towns and villages.

Local governments have not used land use controls widely in the past for purposes of groundwater protection. However, there have been significant recent initiatives on Long Island and in a few upstate areas based on the "hydrogeologic zone" concept.

Site plan reviews and local subdivision controls provide some degree of protection for water supply sources. Agricultural land use laws and programs important for water resources management include: establishment of agricultural districts; implementation of agricultural best management practices; and integrated pest management.

Groundwater Protection

In 1983 New York State enacted the Sole Source Aquifer Incompatible Use Law, which requires DEC to promulgate regulations to prevent "incompatible uses" of hazardous materials within "primary recharge areas of sole source aquifers." This law would allow DEC to expand its regulatory coverage to include bulk storage of non-petroleum hazardous chemicals in any areas designated as sole source aquifers under the federal Safe Drinking Water Act. To date, aquifers have been designated in Schenectady, Endicott-Johnson City and Owego-Waverly. However, no money has been appropriated to promulgate regulations or implement the required management plan.

During the past few years DEC has led a major effort to develop groundwater management programs for Long Island and upstate New York. The final program report for Long Island was completed in June 1986 and the final report for upstate New York was completed in May 1987. One of the major objectives of the programs is to protect the valuable groundwater resource from contamination.

The reports contain extensive discussions of groundwater quality problems and sources of contamination. They present detailed recommendations for groundwater protection.

Key recommendations from the Long Island and upstate groundwater management programs address:

- Resource management actions relating to classifications and standards, geographic targeting and groundwater mapping and resource assessment. The geographic targeting focuses state activities on portions of the land surface which most directly affect groundwater, such as wellhead areas.

- Source control actions relating to hazardous materials storage and handling, oil and hazardous material spills, comprehensive controls for industrial/commercial facilities, wastewater discharge regulation (SPDES), municipal solid waste, hazardous and industrial waste, inactive hazardous waste site cleanup, pesticides and mineral extraction.

- Critical area protection through local aquifer protection programs and state technical assistance and public information.

- State response to groundwater contamination and local water supply planning.

The groundwater management programs are key elements of the state water resources management strategy.

Recommendations

a. DEC should continue to vigorously enforce state pollution control laws.

b. DOH should continue to vigorously enforce state drinking water laws and regulations.

c. DEC should set priorities for environmental management programs, such as discharge permits, solid and hazardous waste disposal and hazardous site waste cleanup, to take into account water quality protection for water supply sources.

d. DEC should ensure that state standards and classifications for surface water and groundwater are adequate to protect water supply sources.

e. DEC should link compliance with discharge permits for sewage treatment plants to state assistance on operation and maintenance and should disseminate information on permit violators to all concerned local entities.

f. DEC should take steps to ensure full implementation of the federal and state sole source aquifer programs, including the Incompatible Uses Law.

g. DEC should provide technical assistance and information to local governments on protecting water supply sources.

h. DEC should require the continuous disinfection of wastewater tributory to sources of public water supply through SPDES permits, as necessary.

i. DOH should ensure that state drinking water standards are stringent enough to protect public health and safety.

j. DOH should issue final guidelines for watershed rules and regulations programs, and require watershed rules and regulations for all water suppliers and develop a program for enforcement of approved watershed rules and regulations.

k. DOH should require water suppliers to report annually on water quality. All water suppliers serving more than 5,000 people should report annually to their customers on issues affecting the water supply, including specific water quality data.

l. DEC and DOH should ensure that surface water, groundwater and drinking water standards are coordinated for consistency.

m. DEC and DOH should identify priority areas for watershed protection, establish special standards for critical watershed protection areas.

n. DEC and DOH should develop alternative methods for watershed protection, involving coordination among state programs for control of point and non-point sources, watershed rules and regulations, and protection of sole source aquifers and wellheads.

o. Local governments should adopt and aggressively apply watershed rules and regulations and land use controls to protect water supply sources including land acquisition program.

2. OBJECTIVE: Treat all surface water supplies.

Since 1963, the DOH has required surface water supplies in New York State to provide disinfection as minimum treatment. Complete treatment, including sedimentation, coagulation/flocculation, filtration, and disinfection, generally has been required only if the water is used for multiple purposes or water quality at the intake is not expected to comply with maximum contaminant levels.

Investigations of waterborne disease outbreaks involving surface water supplies in New York State and elsewhere in recent years have identified as causative agents viral, bacterial or protozoal organisms for which there are not established maximum contaminant levels, and which are resistant to inactivation by commonly used disinfection techniques. It is also possible that surface source waters may contain organic chemicals which have been identified as known or suspected human carcinogens.

The Safe Drinking Water Act Amendments of 1986 require that EPA establish criteria under which surface water supplies must be filtered. EPA has proposed stringent criteria that are currently being revised and will be promulgated shortly. As these criteria apply to all New York systems, the State should consider mandating the filtration of all surface source water supplies. Filtration currently is utilized in only 150 of 323 municipal supplies with surface water sources.

Recommendations

a. DOH should consider mandating filtration of all surface water supplies, and should develop priorities for compliance.

b. Local governments should initiate efforts toward the construction of filtration facilities on surface water supplies.

3. OBJECTIVE: Treat groundwater adequately for drinking water purposes.

Since the early 1970s, DOH has required that all groundwater sources (wells and properly developed springs) be, as a minimum, disinfected. Waivers from this requirement are available if justified on a case-by-case basis.

Additional treatment necessary to reduce other contaminants to the drinking water standards and guidelines is required where appropriate. Of particular concern here is the removal of organic compounds from the groundwater on Long Island.

Moreover, under the Safe Drinking Water Act Amendments of 1986, the U.S. Environmental Protection Agency will mandate, through 1991, maximum contaminant levels (MCL's) for some 83 additional organic chemicals of concern. The Department of Health has recently promulgated MCL's for specific organic chemicals and generic standards for classes of volatile and synthetic organic chemicals.

Application of the new MCL's is expected to result in the need for additional treatment facilities for the removal of organic chemicals. The new regulations are expected to impact most heavily on Long Island, where 45 wells are currently out of service because of chemical contamination.

The sequence of processes which culminates in adequate treatment of groundwater for drinking water purposes involves monitoring to identify affected sources, identification of contaminants of concern and the concentrations at which known or anticipated health risks can be expected, promulgating standards based on established risk criteria, mandating treatment to reduce contaminants to minimal levels in the affected systems, and appropriate responses to contamination incidents to reduce public exposure.

Recommendations

a. DOH should continue the current level of monitoring treatment where existing MCL's are violated, and contamination response procedures when action levels, standards or guidelines are exceeded.

b. DOH should require monitoring for regulated and unregulated contaminants.

c. DOH should implement federal standards as adopted and promulgate and implement specific and generic state standards for organic chemicals.

C. Water Supply System Management

The overall management of water supply systems should ensure the optimum use of water resources of the state continued delivery of a safe and adequate water supply. Many practices and techniques contribute to management efficiency. The more important ones that should be utilized by water suppliers are discussed in this section.

They relate to metering of production and consumption, water rates that reflect the true cost of water, supply management, small water systems, regional water supply systems and interconnections, and water supply management plans. Other sections refer to additional management actions, such as preventive maintenance, capital improvement planning, leak detection and repairs and water conservation plans.

1. OBJECTIVE: Set water rates to reflect the true cost of water.

In public water supply systems, users typically do not pay the true cost of supplying water and treating wastewater. The true cost of water should include all of the costs necessary to plan, design, construct, manage, maintain, operate, upgrade, replace and expand the water supply, treatment and distribution and wastewater collection and treatment systems. As large state and federal subsidies for water resource projects decline, localities will have to shoulder the burden of providing these services. If water rates are held at a level below the cost of water system operation and maintenance, the supplier will have to cover the deficit with tax revenues or by deferring advisable maintenance and capital activities.

Mixing revenues derived from water rates with the general fund allows some suppliers to use water rates for non-water related public functions rather than for water system reinvestment. Water system improvements must then compete with all other services for funds--services which may be more politically popular. Because of inadequate funds, and in some cases a lack of understanding of its cost effectiveness, the maintenance and repair of the water supply systems is often neglected, resulting in water leakage and further deterioration of the infrastructure. This exacerbates the funding problem by increasing the long-term capital cost of rehabilitating or replacing the system, as well as increasing the short-term operating cost because of water lost through leaks. In addition, there may be neglect of water quality tests, and records on consumption, pressure, and quality that would be helpful in diagnosing problems.

When users are undercharged and receive inaccurate information for making decisions about their water use, water may appear to be less expensive than the costs of increasing the efficiency of customer equipment or adopting conservation measures. High consumption rates could also lead to unnecessary investment in new supplies and added treatment and delivery cost.

Recommendations

a. DEC, DOH and PSC should establish uniform accounting procedures that will enable communities to exert better financial control over their water supply systems and thereby manage them more effectively. This would include maintaining a separate water account so that increases in water rates will not be used to pay for other municipal operations that are supported by a general fund.

b. DEC, Office of the Comptroller, and PSC should establish guidelines and audit procedures by which communities can determine the true cost of water including costs of both a water supply and sewerage where one utility provide both services.

c. The state should condition the receipt of any State financial or technical assistance upon water suppliers charging the true cost of water in their area.

d. The state should repeal the provision making water districts ineligible to accumulate capital reserve funds (which reduces their ability to set aside funds and plan for capital improvements).

2. OBJECTIVE: Meter all water supply system.

The majority of public water supply systems in the state have high percentages of their water services metered, but there are a significant number of systems that are only partially metered. These include the large municipal systems in New York City, Buffalo, Rome and Schenectady. Smaller systems with partial metering are located in eastern New York in the Black-St. Lawrence, Capital, Lake Champlain and Mohawk Regions. Another major problem is that many systems that are metered do not use their metering information as a management tool.

Metering is essential to establish equity in water charges, and to make sure that all customers should pay for the water they actually use.

Metering is one of the most effective means to encourage water conservation by customers. Significant reductions in water consumption invariably occur when a flat rate system is converted to metered service. The Jamaica Water Supply Company experience on Long Island illustrates this point. The company, which is the largest investor-owned water company in the state, is implementing a DEC-mandated universal metering program which is about 90% completed at this time. A PSC analysis of changes in average and peak day demands between 1982, when the program started, and the present indicates a significant drop in water usage of about 13.1%. This reduction, in turn, has improved the company's ability to meet its system peak demands.

The drop in production by the Jamaica Water Supply Company has been accompanied by significant reductions in the costs of purchased power and chemicals to treat the water. The corresponding decrease in the total cost of providing water service permitted the PSC to set rates lower than they otherwise would have been. Similar reductions in operating expenses can be achieved by universal metering of other systems. In addition, the need for additional capital facilities may be reduced or postponed, resulting in lower capital costs.

Metering is essential for efficient system management. Production sources, as well as services, should be metered so that detailed computations of lost and unaccounted-for water can be made once the metering of customers is completed. Remedial actions then can be taken to correct the causes of excessive rates of water use and unaccounted-for water.

Metering also provides a means of monitoring water consumption and documenting trends in demand to aid in facility planning. During drought periods, when water use restrictions may be imposed on customers, metering serves as a compliance tool. Most importantly, metering helps achieve long-term water conservation benefits by providing accurate measurements of water use.

State legislation to require water metering has been proposed for a number of years. Bills currently pending in the state legislature would require water purveyors (municipalities and water works corporations) to install or require installation of water meters in all existing commercial, industrial, municipal and residential structures, including multiple dwellings, over a 10-year period. Water meters also would be required in all new structures, and in structures in which there is substantial renovation.

Recommendations

a. The state should enact legislation requiring within 10 years universal metering of all public water supply systems, including both service connections and production sources, and of major self-supplied water users. Household wells would not be included. Self-supplied agricultural water users would not be metered, but would be incorporated within the comprehensive data via a representative sampling program.

b. Localities should be required to maintain accurate records of water consumption by major categories such as residential, commercial and industrial uses, so that rates and billings can be tied to use, and unaccounted-for water can be identified and corrected.

3. OBJECTIVE: Include supply management within system operations.

Through supply management, which may include changes in system operating rules and conjunctive management of different systems or parts of a system, greater production may be obtained from existing sources of supply to meet water demands.

For example, reservoir operating rules that were established at the time of project development may not be representative of hydrologic condition based on the longer period of record currently available and might be modified to reduce spills, thereby increasing water supply yields. Also, more sophisticated modelling and analytical techniques are available now for developing more refined rule curves. Similarly, a reevaluation of demands upon the system could result in a change in operating rules that would result in more efficient utilization of the available supply.

Specific operating rules have not been established for many reservoirs in the state. System managers and operators make "seat-of-the-pants" judgements based on experience that may or may not provide for the best operation. Operating rules are particularly critical for staged actions during drought conditions when it is essential that the available water supply be conserved.Operating rules for wells are equally important, but few have been developed.

Conjunctive management of different systems or parts of a system is another important aspect of supply management. Some systems have multiple sources of supply which may include surface and groundwater sources. Overall yield should be maximized by conjunctive management of the sources. Conjunctive management of different systems is less common, but it is another alternative that should be considered for supply management.

Recommendation

DEC should provide technical assistance to water suppliers on sound management of current supplies, including measures for long-term and emergency demand management leakage and waste control, operating rules, conjunctive management, and public education and information.

4. OBJECTIVE: Give special assistance to small water systems with problems.

Many municipal water supply systems serve fewer than 5,000 people. These small systems play a vital role in supplying treated water to customers in sparsely settled areas of the state although they provide for only 6% of the total municipal demand. Because of their small size, these systems have special problems, including:

Quantity and Quality Limitations: Smaller systems typically have less flexibility in securing alternative or additional water supply sources because they rely upon sources in the immediate vicinity of the population to be served and few have more than a single source of supply. Often these sources are springs or wells vulnerable to local contamination. While technology has been developed to remove most conventional and toxic contaminants from drinking water, many of these technologies may be prohibitively expensive for smaller systems.

Infrastructure problems: Small systems do not enjoy the economies of scale available to larger systems nor do they have the customer base to finance substantial capital improvements. Small systems often do not have an adequate program of infrastructure maintenance, repair or replacement; repairs are made only in crisis situations. Adequate storage for fire flows is often a problem as well.

System management problems: Budgets for small systems rarely provide for operator training, even if such training is available. Operating staffs often are small, so frequently the plant operator has primary responsibilities elsewhere and can give the plant only minimal attention. Small systems may not be able to afford the financing rates for large improvement projects. These systems also present unique problems such as the potential for abandonment or reluctant operation. This leads to questionable (unreliable) operation which could severely impact public health.

These problems require particular state attention because of their widespread nature and because of the limited resources available to small systems for dealing with the problems on their own.

In response to small system problems, the Department of State (DOS), DEC, DOH and the Rensselaerville Institute initiated the New York State Self-Help Support System in 1986 to help small communities to use their own resources to alleviate local water supply and wastewater problems. Self-help techniques include reassessment of the problem and possible solutions, maximizing the use of local resources, and the community serving as its own general contractor for any construction. Tools made available to communities through the Self-Help Support System include case studies, contacts, manuals and workbooks, technical assistance and outreach materials.

Recommendations

a. DOH should continue to place emphasis on the regulation of small water systems to improve their physical condition, operation, and management. The program, implemented by local health units, should include:

   - technical assistance on assessing the condition and adequacy of production equipment, operating procedures, maintenance, available financing for rehabilitation and improvements.

   - a state-sponsored training program to make operator training more readily available to small water systems.

   - encouraging the development and use of new technology directed toward small systems, including the use of package treatment plants and package unit processes.

   - promoting the use of shared management, shared services between systems (such as joint laboratories for two or more systems) or consolidation into larger systems to achieve economies of scale.

b. DEC should provide technical assistance to small water systems on source evaluations, dependable yield determinations, assessment of future needs, leak detection, water conservation and other aspects related to water resources development and assurance of adequate water supply.

c. DOS, DOH and DEC should continue the Self-Help Support System to assist small communities in using their own resources to alleviate local water supply problems.

d. DEC and DOH should develop a computerized uniform data collection and reporting system, and provide training for small systems to improve their monitoring and management programs and to simplify meeting their reporting requirements.

e. Localities should improve operation, maintenance, financing and management of small systems, and overcome limits of small systems by assisting small systems to join with others through measures such as regionalization, privatization or joint service contracts.

5. OBJECTIVE: Establish regional water supply systems and interconnections where feasible.

Regional water supply systems and interconnections are established in many parts of the state, but there are significant opportunities for more regionalization and interconnection of systems.

The substate studies identified regionalization opportunities in nine of the 13 substate regions. These include the New York City water supply system and systems in Nassau; Broome; Jefferson; Saratoga; Monroe; Livingston, Ontario and Wayne; Warren and Washington; Oneida; Oswego and Onondaga Counties.

Regionalization is desirable, particularly for small systems, because of the benefits resulting from economies of scale and the sharing of management, technical and support services. It is not necessary to have 1,700 individual public water supply systems in the state, and regionalization could have a significant impact both from an operational and financial viewpoint.

County-wide water agencies are one form of regionalization. The agencies can have primary responsibility for procuring sufficient quantities of safe water to supply wholesale to various water systems. They also can provide technical help to small water systems on their operations and in developing water conservation programs. Water systems can join together to form water districts in order to take advantage of economies in scale, avoid unnecessary duplication of service, and make the best use of local resources.

The principal objections to regionalization are that it may result in a excessively large facility and higher costs, and that local interests might become subservient to regional needs. One problem with regionalization that PSC has experienced is that the owners of small companies greatly inflated the values of their systems when faced with potential acquisition. There may also be political aspects when considering the acquisition of a small, publicly-owned system which has operated as an independent entity for many years. Community acceptance of regionalization is a key question, so the advantages of a regionalization proposal must be thoroughly demonstrated wherever it is being considered.

The substate studies also identified many interconnection possibilities, particularly in the Long Island, Capital and Erie-Niagara Regions. System interconnections are desirable because they provide greater flexibility for responding to short and long-term water needs. An interconnection allows a water system with a deficiency in supply to obtain water from a system with a surplus, or to obtain water temporarily during emergencies such as drought or supply contamination. Interconnections are particularly important for small systems which are more likely to have supply limitations. Interconnections may not be feasible because of costs and there may be concerns about institutional, political, environmental and water quality aspects.

DEC and DOH encourage the interconnection of water supply systems where technically, economically and environmentally feasible.

However, stronger state incentives are needed to increase the utilization of system interconnections.

Recommendations

a. DEC and DOH should further identify opportunities for regional water supplies and for system interconnections.

b. DEC and DOH should make a more detailed assessment of impediments to regional water supplies and interconnections and identify alternative means of overcoming the impediments.

c. DEC and DOH should provide technical assistance to localities to investigate specific opportunities for regional water supplies and system interconnections.

d. DEC and DOH should require interconnections between water supply systems for (1) permanent use to meet supply deficiencies where necessary and where technically, economically, and environmentally feasible and for (2) temporary use during emergencies such as drought or supply contamination.

6. OBJECTIVE: Plan adequately for meeting present and future water supply needs and responding to emergencies.

Establishing goals, policies and procedures for meeting needs and resolving complex issues and problems faced in water resources management cannot be addressed effectively on an ad hoc basis. Plans should focus on both individual water supply systems and areawide concerns, such as state, county or region, and address both short-term and long-range needs.

Present water supply system planning is not adequate. Most large suppliers have prepared state-mandated emergency and drought contingency plans, but few have long-range plans for their systems. Planning is virtually non-existent for small systems. Local water planning is limited. A few counties, including Orange and Nassau, have prepared updated water supply plans. Suffolk County has developed a comprehensive water resources management program. In response to recent drought experience New York City is actively planning to meet long-range water supply needs.

New York State has recognized the importance of water planning for a long time and in the late 1960s and early 1970s had aggressive state water resources and water supply planning programs. DEC was lead agency in the development of comprehensive multi-purpose plans for water resources management for all the major river basins in the state. DOH was lead agency for comprehensive public water supply studies conducted on a county-wide basis throughout the state. Regional water supply needs in southeastern New York were studied intensively by the Temporary State Commission on Water Supply Needs of Southeastern New York (Southeast Water Supply Commission) and by the U.S. Army Corps of Engineers, as part of the Northeastern United States Water Supply (NEWS) Study. Many recommendations emanated from these planning efforts, but few actions were taken to implement them.

As a result, water issues and problems, both statewide and in southeastern New York, have worsened.

Current state and regional planning is underway through the ongoing process for development and updating of the water resources management strategies. However, planning at this scale cannot address local area and system needs adequately. Companion plans should be developed, at least at the county level, and by each large water supply system.

Recommendation

a. DOH should require within the state Sanitary Code each water supplier with a large system serving more than 5,000 people to prepare a water supply management plan and update it periodically. The plan should include:

   - A water conservation program, as specified in Section A.
   - An assessment of the safe yield and capacity of existing sources of supply and facilities.
   - An analysis of present and future water demands, including an evaluation of the effectiveness of water conservation.
   - A source and facility development program to meet current and projected water demands.
   - A system rehabilitation and improvement program and preventive maintenance plan, based upon results of the detailed system studies of improvement needs specified in Section E1.
   - A capital expansion and improvement plan, as specified in Section D1.
   - A contingency plan including emergency sources (especially for droughts), interconnections for flexible and reliable system operation, water use restrictions, emergency response, and other appropriate actions.
   - The creation of or revision to watershed rules and regulations.

b. DEC and DOH should develop a guidance manual for water system managers to prepare water supply management plans and should develop a pilot management plan.

c. DOH and DEC should provide technical and financial assistance to water suppliers for the preparation and implementation of water supply management plans.

d. DOH should require community water suppliers to prepare and submit emergency plans for coordinated and effective responses to water supply contamination incidents in accordance with recent legislation requiring emergency plans at larger water systems.

e. DEC should encourage counties with significant water supply quantity problems to prepare county water supply management plans; county plans should utilize local and system plans.

f. DEC and DOH should ensure that water supply management plans prepared by water suppliers and counties are mutually consistent for with this statewide strategy.

g. DEC and DOH should conduct comprehensive water resources planning in preparation for revisions of the statewide and substate strategies. Such planning should be directed toward both site-specific programs and projects and further development of the substate strategies.

D. Water Supply System Improvement

1. OBJECTIVE: Conduct water supply system studies as the first step for improvement projects.

New York State has 1,799 municipal and investor-owned public water supply systems serving about 16 million people, or 87.7 percent of the state's population. There are 232 large systems, each serving more than 5,000 people, and 1,567 small systems. Most of the population (82%) is served by the large systems.

The state goals for water service delivery are expressed in the drinking water policies that have been adopted to protect public health. The policies prescribe that there be an adequate quantity of water to meet system demands and that a safe drinking water supply be provided which meets all appropriate quality standards and contaminant guidelines. They further prescribe that all water systems must be properly operated and maintained in order to assure the continued delivery of safe and adequate water supply. Within the context of these state goals each water supplier should have specific water source delivery goals that also reflect local conditions. Among the many local factors that should be considered are the acceptable risk of service interruption, associated economic disruption and impacts of pressure fluctuations. With this kind of information, more prudent decisions could be made on water supply system management and improvement.

Water suppliers have done a commendable job of meeting water service delivery goals, however many of their systems have not been maintained adequately or improved to the extent necessary to meet current water supply standards. This is evident from a number of available detailed system studies, surveys of system operators, and other available information.

The most commonly identified deficiencies are in transmission and distribution facilities, but they occur also in the source, treatment, and storage components.

Problems include undersized pipelines, excessive leakage, high rates of unaccounted-for water, low fire hydrant flows and pressures, insufficient system storage capacity, unsatisfactory water quality, and inadequate treatment facilities. Water supplies may be threatened also with contamination by hazardous substances, particularly organic solvents and petroleum products.

The cost of system improvements cannot be determined accurately without more detailed system data. However, the strategy studies indicate that improvement costs for the next 10 years are on the order of $9 billion for the state, including $7 billion for New York City. This estimate is based on a survey of all 232 large systems, including New York City, and 135 (9%) of the small systems. Additional improvement costs will be incurred as a result of the Safe Drinking Water Act Amendments of 1986.

More consideration and priority should be given to water supply system improvements in the decision making process for allocation of financial resources among competing demands. Detailed studies of individual systems are necessary to determine improvement needs and costs which would provide a sound basis for decision making. Many systems, particularly those that are small, have limited local resources for such studies. A state assistance program would encourage and facilitate the studies and help insure that system improvements are made in a prudent manner.

Recommendations

a. The state should establish a program to provide technical and financial assistance to municipal and investor-owned public water supply systems to complete detailed system studies of improvement needs and to prepare capital expansion and improvement plans as follows:

   i. For small systems serving less than 5,000 people,

      - establish funding limit to 100% of the study cost if the total cost of the study is less than $3,000, or to 50% of the study cost with a minimum of $3,000 and a maximum of $30,000 if the study cost is more than $3,000.

      - provide for state consolidation and management of studies for systems serving less than 5,000 to achieve economy and consistency in planning for small system improvements.

   ii. For large systems serving more than 5,000 people,

      - the detailed system studies of improvement needs shall be carried out as one element of the water management plan recommended in Section C6.

iii. Require that each detailed system study include, as a minimum, a description and evaluation of the system's physical plant and its rate base, as well as identify and establish priorities for improvement needs, cost estimates and analysis of financial and institutional issues.

iv. Require that each capital expansion and improvement plan include establishment of separate accounts for water revenues and costs, and analysis of water rates, system debt and repayment capacity, potential managerial and operational cost savings, and funding mechanisms for systems for which internal financing is not feasible.

v. Require that each capital expansion and improvement plan should be consistent with the statewide and appropriate substate strategies. Deviations from these plans must be justified during the water supply application and/or plan review phase of each project.

b. DEC, DOH and PSC should develop uniform accounting procedures that will enable communities to exert better financial control over their drinking water supply systems and thereby manage them more effectively; establish audit procedures by which communities can determine the "true cost" of water; and improve each community's ability to represent its needs for and its financial capacity to support capital projects that can rehabilitate, improve or expand existing water supply systems.

c. DOH, DEC and PSC should assist water suppliers to establish water service delivery goals based on state policies and local conditions, including risk analysis of service interruption, associated economic disruption and pressure fluctuations.

2. OBJECTIVE: Provide state incentive for financing water supply system improvements.

Financing system improvements of the scope indicated by available information has been a major concern. Considerable state attention has been given to alternative means of providing state assistance, particularly, to making the option of revenue bond financing available on a statewide basis. After extensive deliberations, legislation was enacted in 1984 creating a municipal water finance authority for New York City and establishing a mechanism for local governments to form water and sewer authorities with the capability for revenue bond financing. Actions have been taken to establish local financing authorities in Buffalo, Albany, and Rensselaer, but only the Albany and New York City water authories are operational.

This limited use of the local finance authority mechanism indicates that additional incentive is needed for the many other municipalities in the state to finance their water supply system improvements. The Local Financial Capability Analysis Report prepared by DEC in 1987 shows that in aggregate there is enough residual financial capability in the state's localities to pay for all the water supply capital needs in the state.

However, use of the capability is a local decision, and each locality has its own capital needs and priorities. Incentives are needed to catalyze local governments to use their existing financial capabilities for water supply system improvements. The report indicates that the least cost alternative would be for the state to capitalize a fund to use as leverage for local investments, and to use interest earned off the capital to reduce interest rates to local governments. State assistance should be contingent upon other local actions to improve system management.

Recommendations

a. The state should establish a capital reserve fund from funds obtained primarily through federal grants to provide low-interest revolving loans to water suppliers to improve water supply systems. Funding procedures should include:

   - making each loan contingent upon the completion of a detailed system study, preparation of a capital expansion and improvement plan, establishment of water rates reflecting the true cost of water, implementation of a water conservation program, and such other conditions as may be necessary to insure cost effective solutions and sound fiscal management.

   - establishing priorities for loans based upon such criteria as benefits to public health and safety, compliance with state and federal standards, system adequacy and efficiency, and economic, social and environmental values.

b. The state should continue to seek and support federal technical and financial assistance for improvement of water supply systems by:

   - supporting proposed federal legislation, with appropriate changes, to establish a public water supply assistance program to provide grants to the states for revolving funds to be used for improvement, research, rehabilitation, repair, and modernization of water supply systems.

   - supporting ongoing federal programs for technical assistance on water supply from the U.S. Army Corps of Engineers and for local financial assistance on water supply system improvements from the Farmers Home Administration and Department of Housing and Urban Development.

c. Local governments should continue to establish local water authorities to obtain the capability for revenue bond financing and for other benefits provided by authorities.

E. Data and Research

1. OBJECTIVE: Develop a water resources data base adequate to informed decision-making.

An adequate data base is essential to sound water resources management. Many different kinds of data are needed concerning:
- Water quantity available in surface and groundwater resources.

- Water quality both of the resource and in the delivery system.

- The broad spectrum of water uses, including water supply for domestic and municipal purposes, industry, agriculture, power generation, recreation, navigation, and fish and wildlife.

- Water infrastructure including source, transmission, treatment, storage, and distribution facilities and their deficiencies.

- Water system management including water conservation, revenues, metering, planning, and other factors.

- Environmental and land use factors, including water quality, contamination, fish and wildlife habitat, and other considerations.

Substantial data relating to these different aspects of water resources management have been accumulated in the state by particular agencies that require the data to meet their specific program responsibilities. The principal agencies with water resources-related data responsibilities are DEC, DOH, PSC, A & M, National Weather Service, U.S. Geological Survey, and U.S. Environmental Protection Agency.

DEC is the major source of data on water resources quality, obtained through a broad range of permit regulations for pollutant sources that impact water quality. These include municipal, industrial and commercial wastewater discharges, storage and handling of hazardous and toxic chemicals, solid waste landfills, major oil storage terminals, petroleum bulk storage tanks, and petroleum and hazardous material spills. Most of the water quality data are kept in computerized files for the different programs. DEC also has extensive data on water resources and water supply systems collected from applications and proceedings for upstate public water supply permits and Long Island well permits. The data are contained in engineering reports, well logs, and other information, and are not organized in computer files. Considerable environmental and land use data which are obtained as well by DEC in conjunction with various programs.

DOH is the principal source of data on public water supply systems in the state. The data pertain to water quality, water use, infrastructure, and water system management. DOH maintains data files on system operations through a computerized system (SAFWATER). The data are obtained from monthly reports by suppliers to local health officials, annual inspections by local health officials, and five- and ten-year detailed evaluations by DOH. Most of the data in the monthly reports are from monitoring water quality within the system. The annual inspections and detailed evaluations are broader in scope and provide data on additional factors such as sources and safe yields, population served, production and consumption, storage capacity, pressure, metering, unaccounted-for water, and system conditions.

The DOH computer data bank also includes a wealth of information for program oversight, such as violation summaries, operator data, and other vital system statistics.

PSC has regulatory jurisdiction over private water companies, and is the principal source of data on these systems. The data are provided in annual reports. Most of the report information is financial, and the level of detail varies, depending upon annual operating revenues. The reports also contain system descriptive data on various aspects of water quantity, use, infrastructure, and system management.

A & M has maintained some agricultural water use data including acreage irrigated, water for supplemental irrigation and water needs for agricultural products process industries.

The National Weather Service collects and interprets climatological data from an extensive network of stations in the state. Long-term data on precipitation defines the state's normal water base and the extremes in water supply that may occur. Their forecasts during critical periods are essential for management programs designed to reduce the impacts of floods and droughts.

The U.S. Geological Survey is the major source of data on the quantity and quality of surface and groundwater resources. Much of the information is obtained through a network of stream gaging stations and groundwater observation wells. The USGS also develops data through site specific analytical studies. The data are contained in a computerized data management system (WATSTORE). The USGS also is a source of water use data and has developed a computerized national system which provides a mechanism for the state to store water use data. Recently the U. S. Geological Survey has established a Geographic Information System (GIS) with the capability for geographic analyses, modeling and computer display of data.

The U.S. Environmental Protection Agency (EPA) has water quantity, water quality, and water use-related data in another computerized system (STORET) and also has a GIS. The Corps of Engineers has some data on water supply system infrastructure needs. Interstate river basin commissions in the Delaware and Susquehanna River Basins have data on water quantity, water quality, water use, and environmental and land use factors.

Local sources of data vary considerably. Some local governments, such as Nassau and Suffolk Counties, have extensive data, particularly on quantity and quality aspects of their water resources. Others have very limited data. Local water suppliers are the basic sources of information on water infrastructure and water system management. Regional planning boards have data on environmental and land use factors.

The various state agency data programs have been coordinated reasonably well and no significant overlap or duplication of data has been identified in the strategy studies. There is no apparent need to centralize data responsibilities within a single agency, nor to establish a master water resources data bank in the State.

However, the current data base exists in a variety of forms and at a number of different locations, making it inconvenient to use. Also, the extent of available data is not widely known even among program professionals. DEC should do as much as possible to integrate and coordinate, by category, the data available from different sources in order to increase its usefulness. Linking of existing systems could be the initial step.

Major gaps and deficiencies have been identified in the overall water resources data base available in the state. The most critical deficiencies are in data on needs for water supply system improvements; water use data, particularly for self-supplied uses; and dependable yield data for surface and groundwater sources of water supply. State agency data programs should be expanded to provide the additional data needed. Data accuracy and reliability also should be assured.

Data accessibility is another important consideration. Interagency access to existing data files must be provided to assure that they are used most effectively for decision-making and to avoid duplication of effort. Data management systems should be designed to facilitate the extraction and transfer of data by means of computers.

Recommendations

a. The state should integrate and coordinate state, federal and local agency programs relating to water resources data in order to facilitate data collection, storage, retrieval, and analysis.

   i. designate lead agency responsibility to DEC for integration of data on water quantity, water quality, water use, water conservation, and environmental and land use factors;

   ii. designate lead agency responsibility to DOH for integration of data on water infrastructure and water system management;

b. The state should develop an expanded data base that will provide the character and quality of information required for sound water resources and water supply management.

c. The state should establish a comprehensive data collection and management system in the Great Lakes Basin in accordance with the Great Lakes Charter.

Many different kinds of data are needed for water resources management. The following sections include discussions and recommendations for seven major components: (1) water quantity, (2) water use, (3) water supply systems, (4) dependable yield, (5) facility needs, (6) environment and land use and (7) agricultural supplemental irrigation technology.

Water Quantity Data

Adequate data on water quantity must be available to identify the resource base for management purposes.

The three critical elements are climatological data, particularly for precipitation, and data on surface and groundwater resources.

The climatological data network in the state should be analyzed and modified or expanded to improve the data base for short term and long range forecasting, drought forecasting and assessment of the reliability of water supplies. The surface water data collection system in the state has been curtailed in recent years due to limited funds. The stream flow gaging network needs improvement to better define the variability and availability of surface water resources for water supply and other uses. Generalized data are available on groundwater resources in the state, and detailed hydrologic data have been developed for most of the primary aquifers. Additional data are needed to better define groundwater availability, the boundaries and characteristics of high yielding aquifer systems and site-specific conditions based on information obtained from well logs.

Unregulated well-drilling is a significant problem. There is no mechanism to safeguard existing wells from drawdown caused by new wells. Without a registration requirement for upstate well-drillers, the state lacks adequate information on wells to manage or allocate groundwater resources wisely.

Presently some local governments require information from well drillers and at the national level well drillers are initiating measures for well driller certification, as well as institutional guidelines for the compilation of well data. New York requires a certificate of registration from DEC for well drilling in Kings, Queens, Nassau and Suffolk Counties. Prior to drilling, a driller must file a preliminary report with DEC and, upon completion of drilling, a report giving the well log and other pertinent information on the size and depth of the well, pump capacities and withdrawal of water.

In May 1985 New York supported a Delaware River Basin Commission resolution requiring water wells with capacities of 10,000 gallons or more to be registered with DEC by submittal of well completion reports. Required information includes location of the well, depth, drilling method, estimated daily production, water use, method of wastewater disposal, geologic data from the driller's log, type and size of pump installed and estimated maximum sustainable yield. The reported data will help determine the use and availability of groundwater in the area. A similar program of well registration for the remaining upstate area is recommended in the Upstate New York Groundwater Management Program.

Recommendations

a. The state should support the National Weather Service climatological data program and assist in obtaining improvements necessary to meet the state's water resources data needs.

b. DEC should expand the present cooperative program with USGS to obtain more comprehensive data on the state's surface and groundwater resources, provide for more data analysis and utilize the Geographic Information System (GIS) for resource data management.

c. DEC and USGS should expand the current groundwater observation well network by establishing additional wells in those primary aquifers where they do not presently exist.

d. DEC, working in cooperation with the USGS, should complete the regional mapping of surficial (unconsolidated) aquifers across the entire state at a consistent scale and format.

e. The state should enact legislation to require the registration of well drillers in the state, as now required for Long Island, and to establish a Water Well Construction Code.

f. The state should expand to additional upstate areas the well registration program presently established in the Upper Delaware River Basin through the Delaware River Basin Commission, requiring the submittal of well completion reports with essential data, in order to help determine the availability and use of groundwater statewide.

Water Use Data

Public water supply production is reported to DOH on a monthly basis and is better known than other water uses. There are only limited data on industrial water use for either self-supplied or publicly supplied firms. Similarly, data are lacking on agricultural and commercial uses. It is important that the prior rights of self-supplied users for water, as well as the demands of firms being met by public suppliers, are ensured as new demands for water emerge. Better estimates of these uses are necessary.

Recommendations

a. The state should utilize the integrated standard data base that has been developed by the USGS for all water use data in the state and should actively participate in the USGS program to develop a national report on water use every five years that includes reliable estimates for New York.

b. To help assure future availability of water to meet the needs of existing self-supplied uses, DEC should require major self-supplied industrial, commercial, institutional and agricultural water users withdrawing an average of over 100,000 gallons per day during any 30-day period to file quarterly reports on monthly and maximum daily withdrawals.

c. DEC should develop improved estimates of present and projected self-supplied industrial, commercial, institutional and agricultural water uses, including smaller (less than 100,000 gallons per day) self-supplied uses.

d. The state should establish an agricultural water need-and-use data research and monitoring system, including modelling and forecasting methods, to develop improved and reliable estimates of present and projected agricultural water use, based on significant factors affecting water demands, for integration of such data with that of other water uses.

e. DEC should compile and integrate data on other water uses, such as power generation, navigation and recreation.

Water Supply System Data

Data for water supply system management purposes are collected by water suppliers to meet their own needs and the requirements of state agencies. Local needs vary from system to system and the data collected may vary from little or none to extensive depending upon system size and other factors. State agencies require system data primarily to provide oversight of water quality and financial conditions. There are many gaps and deficiencies in the existing system data which need to be corrected to provide an accurate and reliable data base for local system management decisions and for policy and programmatic decisions at the state level.

Recommendations

a. DOH and DEC should specify methods of water system monitoring, surveillance and record-keeping, and provide technical assistance to water suppliers to improve their data collection and reporting system to meet local and state needs.

b. Water suppliers should be encouraged to purchase and use micro-computers for their data collection and reporting system, where appropriate.

c. The state should provide a data program (including computer applications) and train water suppliers on its use.

d. DEC should computerize key water supply system data in existing upstate public water supply permit files and Long Island well permit files.

Dependable Yield Data

The dependable yield of a surface water supply system is commonly defined as the quantity of water which can be continuously provided through a serious drought, usually the drought of record. Dependable yield may be affected by instream flow management needs for fish and wildlife protection, as well as navigation, recreation, power generation and other uses, even though state policy gives first priority to use of water for domestic and municipal purposes.

The dependable yield of a groundwater system is commonly defined as the amount of water that can be withdrawn without producing "significant undesirable effects." The determination of significant undesirable effects is difficult because a number of diverse environmental, economic and social factors can be involved. For example, withdrawal rates may impact the water table level, stream flow and water quality, and the extent to which the effects can be tolerated is highly judgmental. Criteria need to be established to assist in such evaluations.

Dependable yield determinations are influenced by their definitions and are not absolute limits on water use. Nevertheless, they are essential to evaluate the adequacy of available sources and to determine whether there are deficiencies or surpluses in supply.

Dependable yields have not been determined for most water supply systems in the state, particularly for the small systems. In addition, the accuracy of dependable yield estimates for water supply reservoirs is questionable, in many cases, because of lack of data on reservoir inflows and operations. The determination of dependable yield of an aquifer system is more complex than for a surface water supply, and few such determinations have been made.

Recommendations

a. DEC should establish uniform criteria and methodology for determining the dependable yield of surface and groundwater sources, and provide technical assistance to water suppliers for making these determinations.

b. DEC should use research findings to develop new and improved estimates of dependable yield of water supply sources by significant hydrologic units.

Facility Needs Data

Local water suppliers commonly undertake facility improvements only when system failures or visible leaks and breaks indicate immediate problems. Improved record-keeping of main breaks, system tests, service connections, flows and uses would help operators improve their knowledge of their water supply systems. At a minimum, water suppliers should begin to collect appropriate data and should undertake or share computerized record-keeping. Detailed system studies would be more readily undertaken and updated, and maintenance needs could be determined more accurately, if facility needs data were available.

Recommendations

a. DOH should help local water suppliers develop their capability to gather facility data and should provide information to them on appropriate facility record-keeping.

b. Water suppliers should update and maintain water system maps and inventories and should maintain appropriate data for facility maintenance, including records of main breaks, leakage, system tests, service connections and flows.

Environment and Land Use Data

Water resource decision-making can best be served by identifying and incorporating relevant environmental and land use data. Data should include existing and potential contamination, fish and wildlife requirements, and changing land uses which affect the stability of aquifer recharge, as well as changes in water demands.

A complex array of information about petroleum storage tanks, industrial waste disposal facilities and municipal landfills is needed to make reliable water resource decisions. This is primarily a state government role.

Recommendations

a. DEC should assure that all relevant environment and land use data are obtained and incorporated into water resource decisions.

b. DEC should develop and use an integrated data management system (GIS) to geographically relate aquifer recharge to land use, and in-stream requirements and existing and potential contamination to water uses and water supply needs.

Agricultural Supplemental Irrigation Technology

Agricultural supplemental irrigation is an important water use in the state with about 51,300 acres irrigated in 1982 and about 1680 farms having some irrigated acreage. There has been no significant increase in agricultural irrigation for the state's food-land resource since the mid-1970's, but studies indicate significant potentials for growth based on soil types and water availability. In addition, over 40,000 acres of non-foodland (e.g. golf courses) are irrigated annually, and the trend is for increases in such non-agricultural irrigation. Not included in these figures is the growing, cummulative acreage in urban and suburban areas utilizing irrigation for home lawn care.

Limited information on agricultural supplemental irrigation is available to the farming community and is based on borrowed materials from other states. It is lacking the broad base of current or needed technology or New York State's climate, soils, and food production conditions. Non-agricultural usage of irrigation, ranging from golf courses to home lawns, is steadily increasing throughout the state. There is a significant need to redevelop a state-of-the-art supplemental irrigation technology within the state aimed at maximum efficiency in water use and management, including the quality aspect of chemical-irrigation. The ongoing program should focus on the development and application of best management practices tailored to New York's humid, moist climate instead of borrowed from other regions of the nation with different supplemental irrigation needs. It should be developed through the College of Agriculture and Life Sciences at Cornell University, and should include such program disciplines as, but not limited to, Agricultural Engineering, Agronomy, and Vegetable Crops as well as The Center for Environmental Research and the New York State Water Resources Institute.

Recommendation

The state should evaluate the present extent as well as future potential of supplemental irrigation water use; identify factors affecting the promotion and adoption of more efficient methods of supplemental irrigation; and develop with state financing an ongoing supplemental irrigation technology program based on cooperative arrangements with NYS Cooperative Extension, Cornell University, irrigators, irrigation suppliers and other organizations.

2. OBJECTIVE: Conduct strong and effective water resources research.

Research should be an integral component of the state's water resources management program. The purpose of water resources research is to help achieve better understanding, use, and management of the state's water resources through the development of new technology and more efficient methods for resolving water problems. Research should establish the scientific and technological base required to meet planning objectives. To ensure the maximum benefit of research, the research program should be complemented by technology transfer, dissemination of information, education, and training activities.

Historically, water resources research has involved federal and state agencies, universities, and the private - industrial sector. At the federal level, most research is in the context of agency missions. The principal federal agencies undertaking water research are the Departments of Agriculture, Interior, Housing and Urban Development, Corps of Engineers, Environmental Protection Agency, and Geological Survey.

At the state level, research is conducted on state problems and specific agency mission-oriented problems, often with cooperative funding from federal agencies. The State Water Resources Research Institute established at Cornell University by federal legislation enacted in 1964, and funded through both governmental and private sources, has been a focal point for considerable water resources research in the state.

At the university level, basic and applied water research is conducted on a broad spectrum ranging from narrow, single-interest points of view to interdisciplinary approaches.

Private industrial sector research is directed toward solving particular industry problems such as the development of more efficient water supply and water-using equipment.

In spite of past and current efforts, water resources research has not kept pace with needs in the state. This is evident, in part, from the lengthy list of research needs that has been identified in the water resources management strategy development process.

In recognition of the importance of water resources research, the state in 1987 enacted legislation formally establishing the New York State Water Resources Institute at Cornell University. The Institute also has significant responsibilities for education, training and extension programs. The legislation states that the Institute "shall pursue and sponsor, both at Cornell and elsewhere, investigations and experiments of either a practical or basic nature, the education and training of scientists and specialists, and outreach activities for the dissemination of information and the provision of technical assistance relating to the state's water resources." Possible research programs are listed in the legislation and the Institute is currently assisting the Water Resources Planning Council to establish a research agenda. Priority issues being considered are groundwater contamination and protection, non-point sources, lake eutrophication, and basin problems in the Niagara and Hudson River Basins.

The Institute could be the focal point for a coordinated statewide program utilizing the existing capabilities of federal, state, and local agencies, academic institutions, and the private sector to address water resources management research needs. Such a program must have adequate funding, with continuity and stability, and should give emphasis to coordination and collaboration among the various interests, and the timely transfer of information. Problems and projects should be selected and prioritized according to their relevance, probability of solution, costs and potential benefits, and other pertinent factors. The recommendations that follow are based on findings of the substate studies, review of existing program needs and suggestions of the Water Resources Planning Council members.

Recommendations

a. The state should undertake a long-term research program that addresses the state's water resources management issues and problems in order to insure that these resources can be used for economic growth and development, and for preserving the quality of the environment.

b. The state should affirm the Water Resources Institute at Cornell University as the responsible agency for development of the long-term program in consultation with other interests, and provide adequate funding for development and conduct of the program.

c. The Water Resources Planning Council, with the assistance of the New York State Water Resources Institute, should establish a research agenda, based upon broad input and review, giving priority consideration to areas of research most needed to further development of the water resources strategy for New York State. (The Council has instituted this process and has identified 33 research topics as described in the report, "Toward a Research and Development Agenda for the New York State Water Resources Management Strategy, September, 1988, New York State Water Resources Institute.")

d. The State should consider joint research with other entities on problems of mutual concern. In particular, consideration should be given to joint research with the Delaware River Basin Commission, New York City and other states in the Northeast. Possible areas of research are:

- low consumption water fixtures and equipment,
- use of "automated meter reading,"
- all infrastructure in the public right-of-way

F. Public Awareness, Education and Involvement

1. OBJECTIVE: Integrate public understanding, involvement and support with water resources management.

Many of the problems encountered in providing safe and adequate water supply can be traced to lack of public understanding of, support for, and involvement in water resource management. Problems

such as contamination, shortages, and deteriorating water supply systems could be solved more easily if people placed more value on water resources, understood better what needs to be done to preserve them for beneficial purposes and became involved in water resource management decisions.

In the substate studies it was found that local government officials and the public lack knowledge of water resources issues, technical requirements of water systems and the true costs of providing water service, and that this lack of knowledge causes major difficulties in obtaining adequate budgets.

Each person can have an impact on both water quantity and quality. Individual efforts to conserve water can add up to marked water and energy savings. The ways people fertilize their lawns, dispose of waste oil and excess chemicals, and unclog sinks and septic systems can incrementally but significantly influence water quality.

Of even greater impact are the collective decisions made by individuals through their governments. An informed public that participates in its government's decisions can have a tremendous impact on the quality and quantity of our water resources as well as on the condition and management of the water systems needed to deliver water supplies. As people know more and care more about water resources, they will demand state and federal legislation and funding to preserve water resources. Greater cooperation with state planning and regulatory activities will develop as a result.

A public that understands the diverse values of water resources will support local government decisions to control land uses that could contaminate water, encourage land uses which aid aquifer recharge, and encourage leak detection, metering and conservation programs, and they will insist on adequate planning and funding to ensure a water system that will meet the community's needs.

The communication challenge is to help all sectors of the public to care enough to act wisely in its use of water and in activities that will impact water quality, and to participate through its government to preserve the water resource and maintain system capabilities for delivering water supplies as well as sustaining the source's capabilities for self-supplied users.

DEC is increasing public awareness, understanding and participation through:

- preparation and distribution of informational materials on water quality, quantity and management and information on related topics such as solid waste management.

- encouragement and organization of public participation in related programs (e.g., groundwater management, development and implementation of the petroleum bulk storage law, water quality standards, programs focused on the Great Lakes, etc.).

- regular contact with the media regarding water concerns.

- general environmental education programs through the department's camps and environmental centers.

DOH is planning to increase public awareness, understanding and participation through:

- development and implementation of a public education campaign on organic chemicals in drinking water, primarily focused on Long Island.

- development and implementation of a public education campaign on lead in drinking water and ways to reduce consumer exposures.

- continuation of the Safe Drinking Water Advisory Committee.

- regular contact with the media regarding water concerns.

DOH, environmental management councils, conservation advisory councils, cooperative extension agencies, county and local health departments, county and local planning departments, soil and water conservation districts, environmental and civic groups, trade associations, professional associations such as the American Water Works Association and Rural Water Association, and other concerned citizens produce information that can aid in public education on water resources and potential threats as well as potential mitigation methods.

Recommendations

a. DEC and DOH and other state and local agencies should continue existing public education, awareness, information and/or participation programs but with a concerted effort to reach and actively involve the broader spectrum of water users.

b. DEC, DOH and other state agencies should increase interagency coordination of programs and coordination with local government officials, water suppliers and other interested groups to develop comprehensive information, education, and participation activities on all water resources issues.

c. DEC, DOH and other state agencies should develop new programs and informational materials to increase public awareness, education and involvement in all aspects of water resources management, through such activities as the following:

    i. Develop informational materials for schools on the basics of water quantity and water quality, the full spectrum of beneficial water users and their needs, potential threats and activities to protect water quality, importance of water conservation and how to conserve, how water treatment plants work, how much it costs to supply water, financing mechanisms, local governments' approaches to supplying water, the role of state and federal regulatory programs, etc.

ii. Develop information materials (brochures, flyers, slide shows, exhibits, etc.) on the above topics for interested groups, local officials and citizens.

iii. Hold training sessions and workshops for local officials, water purveyeors, self-supplied users, and interested citizens on protecting water supplies, conservation strategies, demand management, system management and financing strategies.

iv. Focus more attention on media coverage of water resource issues from a balanced standpoint of the variety of water uses through editorial board briefings, and by encouraging feature articles, and radio and television public service announcements.

v. Meet with local officials and self-suppliers responsible for the common good of water supplies to better understand their concerns and problems with providing water for their communities, industries and agriculture.

vi. Conduct field trips to share case studies of communities which have innovative approaches to preserving their water resources.

vii. Keep fully and currently abreast of the problems and needs of each sector of the public needing or supplying water and communicate water supply recommendations by participating in trade association meetings, annual conferences, etc.

viii. Establish an advisory group, including representatives of the private sector, to review and make contributions to agendas and materials to help assure complete and balanced presentation of information for the public.

d. Local agencies should increase coordination of information and education programs at the local level and with state agencies and interested groups and focus more on water resource issues.

e. Local agencies should develop new local programs and informational materials to increase public understanding and involvement, particularly in relation to local water needs, through activities similar to those of state agencies.

Chapter IV Major Substate Water Resources Management Problems Discussion and Recommendations

Introduction

This chapter presents discussion and recommendations for regional and intra-regional water resources issues that are significant and should receive special attention by the state. These include the New York City supply system deficit, the need for a regional institutional framework in the Lower Hudson Region, Long Island groundwater problems, and the need for conjunctive management of New York City surface water, and Long Island and upstate groundwater resources.

A. Delaware-Lower Hudson Region

1. OBJECTIVE: Resolve the New York City water supply deficit issue.

The most significant water quantity issue in the state is the water supply deficit for the New York City system in the Delaware-Lower Hudson Region. The system directly serves all of the city boroughs of Manhattan, Bronx, Brooklyn and Staten Island, and the northwestern part of Queens. It also wholesales water to municipal water systems located in Westchester, Putnam, Orange and Ulster counties and the southeastern portion of Queens which is served by a private utility, the Jamaica Water Supply Company (JWSC).

The system provides water, wholly or in part, to an estimated population of between 7,943,600 and 8,409,300, including 752,400 upstate and 463,000 within the JWSC-Queens franchise area. The range in estimates arises from dispute over the 1980 Census figure for New York City.

The total non-drought demand on the system's upland supply was about 1,535 million gallons per day (mgd) in 1984, including 1,413 mgd within the city, an 8 mgd supplemental supply to JWSC, and 114 mgd to upstate communities, most of which are in Westchester County. By agreement with the city, JWSC may now purchase up to 30 mgd. There is pressure on the city to take over the JWSC, and the NYC Department of Environmental Protection has committed to a 10-year program of infrastructure improvement through which an increasing amount of water from upland sources can be supplied to the Queens section of the JWSC franchise area. The JWSC has submitted a water supply application to DEC for the required approvals to transfer water from the New York City system. The application was returned for further information. Thus, the transfer of water has not received state approval.

Consumption, reported by category as a percentage of water production, is estimated by the city to be 49% residential, 22% industrial and commercial, 19% institutional and other uses, and 9% leakage.

Of the 850,000 service connections within the city, about 20% are metered. In July 1985, the City's Building Code was amended to require the installation of meters in all new, substantially improved or altered residential property. In 1986, the city committed to a 10-year program of universal metering.

The dependable yield of the upland sources supplying the city system is estimated at 1,290 mgd based on the 1961-67 drought. With the present demand of about 1,535 mgd for the service area, the supply deficit is nearly 250 mgd. If the full Jamaica-Queens demand were met by the system, the demand would be about 1,588 mgd and the present supply deficit would be 298 mgd.

There is no consensus on the magnitude of future deficits because of the complexity of projecting future water demands, particularly in view of the city's new universal metering program and the application of a variety of conservation measures. In 1985-86 the Mayor's Intergovernmental Task Force on New York City Water Supply Needs reviewed all previous studies of city water demands including the United States Army Corps of Engineers Northeastern United States Water Supply (NEWS) Study, the work of the Temporary State Commission on Water Supply Needs of Southeastern New York and other studies prepared for the New York City Board of Water Supply and for Westchester County. These studies set a range of increases in demand for the city or region, based on past trends, of between 0.4% and 1.6% per year. Applied to the present total demand on the city system and the total demand of the JWSC-Queens franchise area, the Task Force's projected range for average day demand was 1,620 to 1,930 mgd for the year 2000 and 1,825 to 2,650 mgd for the year 2030.

The Task Force recommended a detailed study of system demand which was begun in April, 1987. The study is scheduled to continue for nearly six years and is being conducted in two phases by a consultant. In Phase 1, lasting 15 months, the consultant is gathering data from a wide variety of sources and is preparing a computer model for making water use projections. Preliminary projections will be made for every category of water use and water loss, as well as for total water demand, for the years 2000, 2010, 2020 and 2030. In addition, a program being developed in Phase I will secure data on water consumption by metering a selected number of currently unmetered accounts. In Phase II, lasting 42 months, the meters will be monitored and results used to refine the Phase I projections of water demand in each category.

Pending completion of the detailed demand study, present information in the Delaware/Lower Hudson Region study indicates that, even with conservation, the water supply deficit for the New York City system will range from 300 to 800 mgd by the year 2030.

Options to eliminate present and projected water supply deficits of varying magnitude for the New York City system have been the focus of many studies. Strong support has been expressed for measures to

reduce water demand, but no consensus has been reached on development of supplemental supplies.

Recommendations

The state should:

a. Endorse New York City efforts to develop and implement comprehensive water conservation and metering programs.

b. Continue the joint effort with New York City and other regional interests to conduct the detailed water demand study.

c. Continue to participate in the evaluation of impacts of the water conservation and metering programs.

d. Continue to participate in the Mayor's Intergovernmental Task Force to evaluate alternatives for long-term water supply.

e. Assist New York City in developing contingency plans for major droughts that may occur during the interim period before other actions to reduce the deficit are completed.

New York City should:

a. Continue to follow up on recommendations in the second interim report (December 1987) of the Mayor's Intergovernmental Task Force for actions in an integrated program to reduce water demand and supplement the supply.

b. Participate in implementation of the statewide and Delaware-Lower Hudson Region water resources management strategies with particular reference to actions to reduce the water supply deficit for the city system.

c. Initiate engineering feasibility studies of the Brooklyn-Queens Aquifer to confirm the quality and yield of the aquifer and determine its potential for use as an alternative to increasing the capacity of the Chelsea pumping stations.

d. Continue preliminary engineering planning for the possible development of Chelsea and alternative sites to determine the maximum potential capacity of the facilities acting as a supplemental supply and utilizing existing aqueducts. These detailed studies of the impact of continuously and nearly continuous (say 10 to 11 months per year) withdrawals at Chelsea and alternative sites should cover such topics as the salt front, chloride and sodium content of the blended supplies, anticipated safe yields of the supplemental supplies, effect of withdrawals on other systems using the Hudson River, etc.

The studies should cover a range of withdrawal rates ranging from 100 to 300 mgd.

e. If the current detailed water demand study indicates that the projected 2030 supply deficit is close to the low end of the present estimated range of 300 to 800 mgd and the studies recommend it may be developed at Chelsea or an alternative site, planning for the supplemental supply should be implemented as quickly as possible.

f. Long-term planning for an additional major water supply in excess of 300 mgd should be initiated. Due to the present uncertainty of actual and projected water deficits for the New York City System, short-term and long-term planning which addresses the development of supplemental supplies is prudent and should be continued while concurrently working to establish more definitive deficit values. This planning activity should look at supply alternatives, demand management, water conservation, hydrologic and ecological impacts, the high flow skimming project and groundwater development in order to provide a thorough cost-benefit analysis of all viable supply options.

2. OBJECTIVE: Establish an adequate regional institutional framework to assure the safety and reliability of local water supplies.

The Delaware-Lower Hudson Region includes about half the population of the state. The largest concentration is in New York City, and the city's water needs dwarf those of the remainder of the region. Nevertheless, water supply is vitally important for the upstate part of the region that includes eight counties with 390 water supply systems serving a total of about 1.6 million people. Average daily municipal water demand within the upstate counties is 224 mgd. The demand is projected to increase by 10 percent by the year 2000 as a result of continued growth in the less developed area of northern Westchester County and in Rockland, Putnam, Dutchess and Orange counties.

The region has an abundance of surface water, and nearly all of the large water supply systems obtain water from surface sources. Groundwater serves roughly 40 percent of the upstate population through small community and private household systems. Many self-supplied industries, institutions and agriculture also use groundwater. Only 15 percent of the upstate population served by wells is supplied from the high yielding primary and principal water supply aquifers.

New York City obtains its water supply from surface sources within the region. As a condition for permission to develop these sources, the State Legislature in 1905 required New York City to allow municipalities and water districts in certain upstate counties to connect to the city's reservoirs and aqueducts. All the counties within the region, except Dutchess and Rockland, were included in the legislation. Westchester County derives a majority of its supply, roughly 90 percent, from the system. Putnam, Orange and Ulster counties draw on the city system for approximately 38%, 9% and 8% of their average day municipal demand, respectively.

The close interrelationship between New York City and local water supplies within the region is a significant factor in the management and operation of many local systems. Also, any development of additional water supply from the Hudson River would have significant implications for the quality and quantity of water available for municipal supplies farther upstream on the Hudson River, such as for the City of Poughkeepsie, the Village of Rhinebeck and the proposed Hyde Park Fire and Water District project for using the Hudson River. Finally, it should be noted that the Delaware-Lower Hudson Region has major interstate water management involvements with the Delaware River Basin that are related to some extent to local water supplies.

Because of these special considerations, it is essential that the region have an institutional framework that provides adequately for local participation and representation in the decision-making process for dealing with the complicated water resource management issues that affect the region. This would help maintain the integrity of local water supplies for meeting present and future needs.

Recommendations

a. A regional water planning entity should be created to address the long term needs of Southeast New York. It should include representatives from the Hudson and Delaware Watersheds, New York City, Long Island, the Water Resources Planning Council and other interested municipalities.

b. Outside the water supply boundaries of the New York City System, County-wide water agencies could have primary responsibility for procuring sufficient quantities of good quality water to supply wholesale to various water systems. They could provide technical help to small water systems on their operations and in developing water conservation plans.

c. Each County should undertake a planning effort that reviews water management and planning issues such as but not limited to:

- Emergency preparedness
- Problems of small systems
- Wholesaling and demand needs
- Watershed Rules and Regulations
- Public education
- Water conservation
- Implementation of substate strategy
- Feasibility of instituting water quality treatment districts

This information should be provided to the regional planning entity which should incorporate this data into its planning activities and recommendations.

d. A regional institutional framework should be explored to address long-term supply requirements that may come from the planning process. This is particularly important if there is a need to develop an additional supply to meet the requirements of the Hudson and Delaware Watersheds, New York City, and Long Island. This plan will address the needs of all water users, both for those users inside the New York City system as well as those outside the system.

e. The possibility of further expansion of the New York City System to accommodate regional growth pressures should be explored. This might provide the opportunity for efficient and economical distribution of water to communities not currently served by the New York City System. The 1905 legislation should be reviewed to determine if new legislation is needed to facilitate development of new sources that may be beneficial to both the City and the upstate counties.

B. Long Island Region

1. OBJECTIVE: Protect and manage groundwater quantity and quality effectively to meet present and future water needs.

The focus of this discussion is on the quantity aspect of groundwater management in the counties of Nassau and Suffolk on Long Island. The aquifer system on the island is the single most important groundwater resource in the state and the sole source of supply for three million residents, as well as for commercial, institutional and agricultural users.

Pollution and excessive consumptive use have created stresses in parts of the aquifer systems. Although drinking water supplies are generally safe, pollution problems and threats of new contamination have forced some wells to be deepened and others to be abandoned or restricted in use. Increased consumptive use has caused saltwater intrusion in southern Nassau and southeastern Queens Counties. Water conservation is increasingly crucial to help manage the quantity and quality of groundwater.

Groundwater is adequate throughout most of the region, except for some insular areas and islands. However, there is a limit to the amount of water that can be pumped and consumptively used without undesirable results. Nassau County's consumptive use currently is at or above most estimates of the permissible sustained yield of its groundwater system. In Suffolk County there are adequate supplies, although local deficits exist.

The designated best use of Long Island groundwater is for potable water supply. In the region there are 84 municipal water supply systems serving populations from 20 to 875,000. There also are a large number of private wells. The total regional demand of consumers supplied by community water systems and those that draw their own supply (domestic, industrial and agricultural users) presently averages about 450 mgd. The total demand is expected to increase by about 9% by the year 2000 without conservation measures.

Water conservation is the most likely option for meeting additional future water demands. Other possibilities are transfer of water from surplus to deficit areas, utilization of upstate surface water resources through the New York City water supply system and/or conjunctive management of upstate surface supplies with Long Island groundwater supplies.

The seriousness of groundwater quality problems on Long Island also must be recognized because they are the most extensive and impact the largest population of any area in the state. Since the mid-1970s, when organic contamination first surfaced as a significant problem, about 90 of the approximately 1,000 major public drinking water wells on Long Island have been closed or restricted in their use because of contamination from synthetic organic chemicals and nitrates. Private wells have also been contaminated by synthetic organics, pesticides, petroleum products and nitrates; 1,400 private wells in eastern Suffolk County, for example, have been contaminated by pesticides.

Increased concern about the magnitude and complexity of groundwater problems, particularly the threat of pollution by toxic substances, led to a review of resource management needs and development of the Long Island Groundwater Management Program (LIGMP). The LIGMP Report (DEC, June 1986) contains the framework for program actions to protect and improve the quantity and quality of groundwater. The majority of the recommendations are preventive in nature and address quality issues.

The LIGMP introduced the concept of "stressed segments," in which a portion of the aquifer flow regime has been stressed, which results in adverse hydrologic conditions. Initial stressed segments were identified in Queens, Nassau and Suffolk Counties and it was recognized that review and updating are necessary to add new areas or to revise the existing areas. The program recommends that quantity-stressed and impending quantity-stressed areas receive priority for early attention through the Long Island Well Permit Program to develop area-specific guidelines for the issuance of permits through which the adverse quantity stresses ultimately could be corrected.

In 1986, the Environmental Conservation Law was amended to require DEC to categorize portions of the Long Island aquifer as over-stressed, transitional or unstressed, and to reopen the water supply permits in over-stressed areas and reissue them with limitations or "caps" on the amount of water taken.

The DEC regional office at Stony Brook, which administers the Long Island Well Permit Program, instituted a program to halt the increase of water withdrawals in Nassau County. Caps on maximum annual and five-year running average groundwater withdrawals have been set for each public water supply system. The caps are being put in place by modifications to existing water supply permits or as conditions in new permits and with a requirement that each water supplier develop and implement a water conservation program.

Recommendations

a. The state, in cooperation with the USGS and Nassau and Suffolk counties, should maintain an island-wide hydrologic data base and an integrated data management system, incorporating the work currently being carried out by all involved agencies, in order to continually assess the affects of consumptive water use and changes in recharge throughout the region and including Queens County.

b. DEC, with assistance from the interested and affected local, state and federal agencies, should complete the development of quantity-specific criteria for the region's water resources, particularly for the determination of aquifer yield, based upon consideration of significant parameters.

c. DEC and county agencies should identify present or future water quantity shortfall areas, and the counties should develop specific plans to decrease consumptive water use in the affected areas.

d. DEC, DOH, USGS and Nassau and Suffolk counties should develop a comprehensive ground and surface water monitoring system that is responsive to the development of specific water quality criteria and the need for information on groundwater depletion.

e. DEC should continue to enforce the pumpage limitations and related water conservation requirements for Nassau County water suppliers and for the Jamaica Water Supply Company, with necessary adjustments as conditions and new information warrant.

f. DEC should continue to require water conservation plans of all Nassau County water suppliers and should require conservation plans as part of all Long Island well permit applications.

g. DEC, USGS and Nassau County should investigate the hydrology, yields and saltwater interface of the Lloyd and Magothy Aquifers in Nassau County. Future adjustments in the current moratorium on well permits in the Lloyd aquifer should be considered based on this knowledge.

h. DEC should conduct annual management-level meetings of all key regulatory agencies to review the Long Island Groundwater Management Program implementation, problems, priorities and program resource deployment.

i. DEC should implement site-as-a-system management in areas of industrial and commercial activities that involve existing or potential groundwater contamination by synthetic organic chemicals.

j. Nassau County should update and make final the draft Master Water Plan for Nassau County to provide a clear framework for county water resource management activities. The plan should give priority to water conservation to provide sufficient water supply in areas with present and projected quantity shortfalls.

k. Nassau County should conduct more detailed studies, including environmental impacts, for development of the intra-county transmission system, as proposed by the draft Nassau County Master Plan.

l. Suffolk County should implement the recommendations of the Suffolk County Water Resources Management Plan to help insure continued water supply within the county.

m. The Suffolk County Water Authority should continue efforts to extend its service into areas presently not served, particularly areas experiencing contamination of private wells and those proposed by the Suffolk County Comprehensive Management Plan for transmission main extension.

n. Local governments and water suppliers should implement additional water conservation measures in areas where supply is a major concern, including all of Nassau County and the insular areas of Suffolk County.

o. All agencies should continue to implement the recommendations of the Long Island Groundwater Management Program (DEC, 1986) in order to protect and preserve the groundwater quantity and quality in the region and to coordinate monitoring activities. The Long Island Coordinating Council should meet on a regular basis.

C. Major Inter-Region Water Management

1. OBJECTIVE: Investigate conjunctive management of New York City water and Long Island groundwater sources.

Conjunctive use of surface water and groundwater sources is a common practice for water systems that have multiple sources of supply. Depending upon variable quantity and quality conditions, withdrawals may be shifted from one source to another to meet system demands. With this operational flexibility the system manager can reduce the stress on a particular source of supply and may be able to produce better quality water.

On a broader, regional basis and more sophisticated scale than for an individual water supply system, conjunctive management has been proposed for New York City surface water sources and Long Island groundwater to help meet water supply management needs in both areas. The concept is to transmit surplus water that would otherwise overflow from the city's upland reservoirs to Long Island for water supply, permitting the groundwater pumpage to be decreased and allowing the groundwater aquifer to recharge. In turn, during times of surface water shortage, additional water would be pumped

from the aquifer to provide a supplemental supply for New York City.

Some information on the potential for groundwater use in Brooklyn and Queens is provided by two recent studies that looked at the Brooklyn/Queens aquifer as a possible drought or supplemental supply for the city. The first study is a five-year comprehensive study of the groundwater resources that defined the configuration of the aquifer and confining units beneath Brooklyn and Queens and incorporated this information into a Long Island groundwater regional flow model. The second study used the model to run a series of simulations of various future groundwater pumping regimes to predict their effect on the aquifers and the available groundwater supply.

The data currently available relate primarily to the hydrology of the aquifer sources and do not deal with the engineering, quality, cost and managerial aspects of using the Brooklyn/Queens sources as a supplemental supply. Conceptual engineering studies, cost estimates and more intensive hydrologic studies are needed to determine project feasibility.

The concept of going a step further and exchanging water between New York City's reservoir supplies and Long Island's aquifer supplies as parts of a single system has received considerable attention, but has not been studied to any significant extent. The Mayor's Intergovernmental Task Force considers the idea to be only a "theoretical possibility" at present and recommends continuing discussions between the city and Long Island counties, including consideration of the institutional framework and transmission network necessary to manage the exchange.

From a state perspective the conjunctive management concept appears to have sufficient merit for helping to meet water resource management objectives and water supply needs in the New York City-Long Island region to justify detailed study.

Recommendation

> New York State, New York City and appropriate federal agencies should investigate in detail all aspects of conjunctive management of New York City water supplies and Long Island groundwater and develop a definitive recommendation on the feasibility of this option for inter-region water management.

D. Upstate Groundwater Management

1. OBJECTIVE: Safeguard quantity and quality of groundwater resources in the the upstate regions

Groundwater is critically important as a source of drinking water in upstate New York. It is also a uniquely vulnerable resource because it is nearly impossible to clean up once it becomes polluted. Roughly 10% of the upstate area is underlaid with groundwater aquifers that provide major present or potential sources of drinking water. Community water supply systems and individual household wells that draw upon that groundwater serve about three million people.

Most upstate groundwater is of good quality, but during recent years the resource has shown signs of deterioration in quality. Contamination by hazardous substances, particularly organic solvents and petroleum products, is the chief concern. Other contaminants, including nitrates, chlorides, and pesticides, are also found occasionally in upstate groundwater.

Quantity problems are localized and generally of a seasonal nature. They relate primarily to inadequate source development or lack of system storage. Quantity problems will occur more frequently in the future in areas where additional growth and development places stress on the local groundwater resource.

Detailed information about upstate groundwater quantity and quality is contained in the Upstate Groundwater Management Program prepared by DEC in 1987. That program is designed to (1) protect and preserve groundwater for best usage as drinking water supply, (2) address quantity as well as quality concerns, (3) emphasize problem prevention (4) give special emphasis to critical high-yielding aquifer systems and (5) foster a state/local partnership in groundwater management.

The Upstate Groundwater Management Program has been incorporated into the statewide water resources management strategy through many of the following recommendations for upstate groundwater management.

Recommendations

1. The state should maintain the existing 6NYCRR Part 703, Groundwater Classifications, Quality Standards and Effluent Standards, as part of the state's Groundwater Management Program, to support the policy objective that all fresh groundwaters in the state will be preserved for the best usage as potable water.

2. DEC and DOH should continue efforts to establish sound and defensible standards for both drinking water and ambient water quality and to reconcile any inconsistencies that may exist.

3. DEC should consider reclassification of surface water segments supplying adjacent public water supply wells.

4. The state should use the following priority system to geographically target groundwater management policies and activities in the upstate area:

   - public water supply wellhead areas
   - primary water supply aquifer areas
   - principal aquifer areas
   - other areas

5. The state should use the following additional geographic categories to further tailor programs to specific local conditions:

   - critical recharge areas within primary aquifer areas
   - special groundwater management areas within primary aquifer areas
   - other areas hydrogeologically tributory to primary or principal aquifer areas

6. DEC should require, through the public water supply permit program, that all upstate public water supplies using more than 100,000 gallons per day from groundwater define the wellhead areas of their supply wells, and DEC should identify and disseminate information on appropriate methods which can be used for such definition.

7. DEC and DOH should evaluate the scope of rural drinking water problems, which are related primarily to groundwater sources, and potential alternatives for state action.

8. DEC should implement a pollution source-oriented monitoring program for sensitive groundwater aquifers (primary and principal) through use of existing regulatory permit mechanisms.

9. DOH should design maintain its public water supply monitoring requirements and emphasize surveillance for organics in locations where potential organics sources are prevalent.

10. DEC should maintain a groundwater problem inventory for use in program performance assessment, priority setting, and refinement of programs.

11. DOH should maintain the Public Water Supply Well Closure List for the important information it provides on major groundwater contamination incidents and as a valuable management tool in determining program priorities.

12. The state should amend the Incompatible Uses Law to add 15 upstate aquifers as primary aquifers, and DEC should implement the law.

13. DEC should undertake two pilot study efforts to evaluate the effectiveness and costs of Site-as-a-System Industrial Facility Management in separate upstate primary water supply aquifers.

14. DEC and DOH should encourage local governments to develop critical area protection programs for primary public water supply aquifers and principal aquifers within their local jurisdictions; local critical area protection programs should be tailored to local conditions and needs.

15. DEC shall develop a technical guidance manual for local government on land use controls to assist in protecting sensitive groundwater areas. This guidance manual will provide specific technical guidance on planning processes and zoning applications under New York's zoning enabling statutes. DOS should assist DEC in this task.

16. DOH should aggressively pursue effective watershed rules and regulations for all public water supply wellhead areas, including the development of guidelines on use of watershed rules and regulations to complement other elements of a local groundwater area protection program.

17. DEC and DOH should maintain an adequate, balanced groundwater contamination response capability.

18. All state agencies and other relevant parties should continue to implement recommendations of the Upstate Groundwater Management Program.

19. DEC should revise the Petroleum Bulk Storage regulations to achieve equivalency with the federal underground storage tank regulations. Legislative authority to achieve the objective should be pursued.

20. The state should amend Article 40 of the ECL (Hazardous Substances Bulk Storage Law) to provide DEC with authority to regulate drum storage sites, where aggregate storage exceed 250 gallon.

21. DEC should prepare technical guidance manual on proper storage and handling of hazardous substances. The manual should focus on engineering practices for preventing leaks, spills and chemical accidents which could cause a release to the environment.

Chapter V - Strategy Implementation

A. Responsibilities

1. Water Resources Planning Council

The Water Resources Planning Council is designated in the Water Resources Management Strategy Act of 1984 to receive the statewide water resources management strategy, composed of substate strategies, hold public hearing in each of the substate regions, and determine whether the strategy should be "approved with modifications or disapproved." The approved strategy must be adopted by the Departments of Environmental Conservation and Health and other appropriate state agencies in a form determined by the Council. The Council is also designated to receive the substate water resources management strategies as soon as they are developed. The Departments of Environmental Conservation and Health were required to report regularly to the Council during the development of the strategies and or receive the Council's recommendations and directions.

The Council had an active role in preparation of the statewide and substate strategies. The Council developed criteria for the strategies and reviewed and discussed the strategy development process and water resources management issues. After completion of a draft statewide strategy in May 1987 the Council held public a draft hearings throughout the state, conducted a detailed review and provided significant comments for revisions to the draft.

The 1984 Act also requires that at least once every two years the strategy be reviewed and, if necessary, amended. Council approval is required for a decision that no amendments are required or for any amendments that are proposed. The Act is less specific on the role of the Council in implementation of the statewide water resources management strategy. The strategy must contain recommendations regarding implementation by state agencies, local governments and special districts.

There is a continuing need for overall guidance and direction at the state level on implementation of the strategy, particularly in relation to state policies and legal, financial and institutional aspects. This function can be performed best by the Council, because of its broad representation of the executive and legislative branches of state government and of public interests, and because of the expertise gained by the members through their involvement in development of the strategy.

2. State Agencies

Many state agencies have authorities and responsibilities related to water supply and water resources management. Principal among these are the agencies represented on the Water Resources Planning Council, including the Departments of Agriculture and Markets, Economic Development Energy, Environmental Conservation, Health, State and Transportation and the Public Service Commission (see Appendix).

Three of the agencies, Environmental Conservation, Health and the Public Service Commission, have the most direct responsibilities for implementation of the strategy recommendations. The Department of State also has a key role through its responsibility for state agency liaison to local government.

Department of Environmental Conservation

The Department of Environmental Conservation (DEC) is the state's environmental agency with the responsibility for administering a broad range of environmental quality and natural resource programs. In effect, DEC is the designated custodian of the state's natural resources, including water in the environment. DEC has broad authority to regulate and manage water resources within the state and specific authorities for public water supply permits and other water supply regulation, for comprehensive water resources planning and for water resources studies. DEC also is responsible for prevention and control of water pollution and maintains a comprehensive water quality program.

Department of Health

The Department of Health (DOH), under the New York State Public Health Law, is responsible generally for the protection of public health and more particularly to assure a safe, potable supply of drinking water for the state's citizens. Generally, it is responsible for the regulation/oversight of water which has been withdrawn by public water supplies for distribution to the consumer.

Under the Public Health Law and Part 5 of the State Sanitary Code, DOH administers a major program to assure that all public water supply systems in the state are properly operated and maintained and that all consumers are assured delivery of a safe and adequate supply of water.

County Health Departments and State District Offices are local agents for DOH and responsible for monitoring of water supply systems.

Public Service Commission

The Public Service Commission (PSC) has broad regulatory authority over the furnishing or distribution of water for domestic, commercial or public uses by private and investor-owned water supply systems. Its jurisdiction covers rates, charges, rules and regulations for water service, and the issuance of various forms of securities and service. The PSC is in the Department of Public Service which is the administrative arm of the Commission. Department staff carrying out a broad range of activities related to PSC water supply responsibilities.

Department of State

The Department of State (DOS) is the principal state agency liaison to local government and the state's designated coastal and inland waterways management agency.

In carrying out these responsibilities, particularly in providing services to local governments, DOS can significantly augment efforts to implement many of the recommendations in the water resources management strategy. The services are provided through the Office of Local Government Services (OLGS) which has staff expertise and experience with local governments in New York regarding environmental and land use activities.

Local Agencies

Local agencies have the ultimate responsibility for implementing many of the actions require in the state water resources management strategy since water supply is essentially a local responsibility. There are a variety of agencies at the regional, county, and local government levels, as well as investor-owned water works companies, involved in water supply (see Appendix). In many cases water suppliers will be responsible for the implementing actions.

Public

Public participation is an essential element of the water resources management strategy. During the strategy development process, public views and input on water resources management needs, problems, issues and proposed actions, were sought, and are reflected in the strategy. Public involvement and support is equally vital for implementation of the actions recommended in the strategy. There must be strong public recognition of the need for action and willingness to pay the costs associated with safe and adequate water supplies in the state.

B. Implementation Plan

The water resources management strategy contains recommendations for many state and local actions required to improve water resources management and water supply systems in the state. Additional laws and regulations are needed and the state needs to provide technical and financial assistance to water suppliers, conduct special studies of particular water issues, expand existing water resources and water supply programs and undertake new programs and initiatives. The major actions recommended in these categories are summarized in Table V-1.

All of the recommended actions in the state water resources management strategy are listed in Table V-3 at the end of this chapter. The priority, lead/assisting agency, time frame and estimated cost are shown for each recommendation. The categories of priority are "high", "medium", and "low". The designated of lead/assisting agency is consistent with current program responsibilities. The overall strategy time frame is to the year 2000. New legislation should be enacted in 1989, and major new programs should be initiated by 1990. Costs are in order of magnitude estimates that are designed to assist in evaluations and comparisons. In some cases, more detailed cost estimates are available; others will be prepared during the program development process. The implementation plan for the state water resources management strategy includes actions to be taken by the designated agencies during the next three years, 1989-1991, to implement the major strategy recommendations.

The actions are subject to the availability of funds and do not represent individual agency commitments in the absence of adequate funding. Funding needs are summarized in Table V-2.

Table V-1 - Summary of Major Strategy Recommendations by Kind of Action Required.

1. New state legislation is required for:

   - Registration of large water withdrawals.
   - Permit program for large diversions and consumptive uses.
   - Universal metering of all public water supply systems.
   - Registration of well drillers.
   - Low interest loans to improve public water supply systems.
   - Provide financial assistance to small systems for detailed system studies of improvement needs.

2. - New and/or revised state regulations are required for:

   - Prepare water supply management plans.
   - Prepare capital expansion and improvement plans.
   - Establish watershed rules and regulations and land use controls.

3. State technical assistance should be provided to water suppliers to:

   - Prepare water conservation plans, document conservation savings
   - Implement leakage control.
   - Determine their true cost of water service.
   - Develop operating rules and investigate conjunctive management.
   - Improve small water systems.
   - Establish computerized data collection and reporting system.
   - Investigate regional water supplies and system interconnection.
   - Make detailed system studies of improvement needs.
   - Establish uniform accounting procedures.
   - Determine dependable yields.

4. Additional actions should be taken by water suppliers to:

   - Filter all surface water supplies.
   - Monitor groundwater for contaminants.
   - Prepare annual reports on water quality.
   - Prepare water conservation plans.
   - Prepare reports on water use and other factors.
   - Prepare water supply system management plans.

5. Special state studies should be made of:

   - Need for additional permits or allocation system.
   - Modifications of state low flow fixtures law.
   - Research agenda.
   - Conjunctive management of New York City and Long Island water supplies.
   - Water demands on New York City system.

Immediate Actions for Strategy Implementation

1. Additional State Actions on Water Quantity

   a. New York State Water Resources Legislation

      DEC will lead a concerted effort among all interested parties to resolve any differences on state legislation recommended in the strategy to reach a consensus on bills to be enacted by the State Legislature. The effort will apply to recommended legislation relating to registration of water withdrawals, permits for large diversions and consumptive uses, universal metering of all public water supply systems and registration of well drillers.

   b. Expanded State Water Conservation Program

      DEC, DOH and PSC will implement new initiatives to establish an effective long-term statewide water conservation program. Large water suppliers will be required to prepare water conservation plans for their systems, and the state will provide technical assistance on the plans and, particularly, on leakage control. DEC and DOH will establish and maintain comprehensive public information and education programs on water conservation. DEC will evaluate modifications of the state low flow fixtures law to increase its effectiveness.

   c. Expanded Instream Flow Management Program

      1. DEC will develop supporting information and seek formal adoption of state policy that flows in all streams from source to mouth shall not be reduced below minimums necessary to assure the protection of natural resources, maintain adequate water quality, quantity, assimilative capacity, recreation agriculture, transportation, and power generation uses while recognizing domestic water supply has the priority use of the state water resources.

      2. DEC will develop criteria for minimum flows to be applied to all waters of the state, based on natural stream hydrology with existing streams and river conditions.

      3. DEC in cooperation with other interested state, agencies, authorities, and public interest groups, will review the operation of all existing impoundments (meeting the thresholds of ECL 15-0503) to identify problems and opportunities to balance competing water uses through instream flow management while not significantly impairing the intended purpose of the impoundment.

2. Additional State Actions on Water Quality

   a. To protect and improve the quality of water resources, DEC will continue to enforce state pollution control laws vigorously, will set priorities for environmental management programs to take into account water quality protection for water supply sources and will ensure that state standards and classifications for surface water and groundwater are adequate to protect water supply sources.

b. To provide water supplies of satisfactory quality, DOH will ensure that state drinking water standards are stringent enough to protect public health and safety and will continue to vigorously enforce drinking water standards.

c. To provide additional protection for water supply sources, DOH will revise and update the existing watershed rules and regulations program, and consider mandating rules and regulations for all water suppliers.

d. To provide adequate treatment of surface water supplies, DOH will amend the State Sanitary Code to require filtration of all vulnerable surface water suppliers and will develop priorities for compliance.

e. To provide adequate treatment of groundwater supplies for drinking water purposes DOH will continue the current level of monitoring groundwater treatment and contamination responses procedures; require groundwater monitoring for regulated and unregulated contaminants; implement federal groundwater standards as adopted; and promulgate and implement specific and general state standards for organic chemicals.

3. Additional State Assistance on Water Supply System Management

a. To achieve the goal of charging the true cost of water, DEC, Audit and Control and PSC will develop uniform accounting procedures that will enable communities to exert better financial control over and thereby manage more effectively their drinking water supply systems; establish guidelines and audit procedures by which communities can determine the "true cost" of water and improve each community's ability to represent its needs for and its financial capacity to support capital projects that can rehabilitate, improve or expand existing water supply systems.

b. DEC, DOH and DOS will continue to meet the special needs of small water supply systems in the state. DOH will continue to oversee the compliance at small systems including additional technical assistance. DEC will provide technical assistance on source evaluations, dependable yield determinations, assessment of future needs, leak detection, water conservation and other aspects. DOS will continue the Self-help Support System to assist small communities in using their own resources to alleviate local water supply problems.

c. DEC and DOH should ensure that water supply systems adequately plan to meet present and future needs and to respond to emergencies. DEC and DOH will require each water supplier with a large system serving more than 5,000 people to prepare a water supply management plan containing specified information, and to update it periodically. The agencies will develop a guidance manual and pilot management plan, and the state will provide other technical and financial assistance for preparation and implementation of the water supply management plans.

d. DEC and DOH should conduct comprehensive water resources planning in preparation for a revision of the statewide and substate strategies. Such planning should be directed toward both site specific programs and projects and further development of the substate strategies.

4. New State Program for Water Supply System Improvement

DEC and DOH will develop additional supporting data and information and take other action that may be necessary to establish a state program of incentives for water supply system improvements recommended in the strategy. The program will include two major parts: (1) provision of technical and financial assistance to small municipal and investor-owned public water supply systems to complete detailed system studies of improvement needs and prepare capital expansion and improvement plans, and (2) establishment of a capital reserve fund from funds obtained primarily through federal grants to provide low interest loans to municipalities to improve their public water supply systems.

5. Integrated and Expanded State Water Data Program

a. To provide an adequate state water data program DEC and DOH will integrate and coordinate the state, federal and local agency programs relating to water resources data in order to facilitate data collection, storage, retrieval and analysis and will develop an expanded data based that will provide the character and quality of information required for sound water resources and water supply management for all water users.

b. To meet special water data needs in the Great Lakes Basin, DEC will establish a comprehensive data collection and management system in the Great Lakes Basin in accordance with the Great Lakes Charter.

c. DEC will expand the present cooperative program with USGS to obtain more comprehensive data on the state's surface and groundwater resources, provide for more data analysis and utilize the Geographic Information System (GIS) for resource data management.

d. To obtain more adequate groundwater data, DEC will expand to additional upstate areas the well registration program presently established in the Upper Delaware River Basin.

e. To provide more accurate data on self-supplied agricultural water need, and the availability of that data for integration within an expanded database of all water uses, the Department of Agriculture and Markets will establish an agricultural water use data research and monitoring system, including modeling and forecasting methods Cornell University, the Departments of Agriculture and Markets, and Environmental Conservation, and the Water Resources Institute will provide supporting information for establishment of the system.

f. DEC will establish uniform criteria and methodology for determining the dependable yield of surface and groundwater sources, and provide technical assistance to water suppliers for making these determinations.

g. The Department of Agriculture and Markets, through the establishment and implementation of the Irrigation Technology Program, will evaluate the extent of supplemental irrigation water use; identify factors affecting the adoption of supplemental irrigation; and develop a

supplemental irrigation technology program based on cooperative arrangements with New York State Cooperative Extension, Cornell University, irrigators, irrigation suppliers and other organizations aimed at water use efficiency and water quality protection for agricultural food production, as well as home and recreational turf management.

6. New Long-Term Water Research Program

The state will establish a long-term research program and a research agenda, based upon broad input and review, giving priority consideration to needs that have been identified in the strategy.

7. Expanded Public Information, Education and Involvement Program

DEC and DOH and other state and local agencies will continue existing public education, awareness, information and/or participation program; increase program coordination; and develop new program initiatives and informational materials.

8. Major Regional Programs

a. To help resolve the New York City water supply deficit issue, DEC and DOH will:

1. Endorse New York City efforts to develop, implement and evaluate comprehensive water conservation and metering programs.

2. Continue the joint effort with New York City and other regional interests to complete the detailed water demand study.

3. Continue to participate on the Mayor's Intergovernmental Task Force to evaluate alternatives for long-term water supply.

4. Assist New York City in developing contingency plans for major droughts that may occur during the interim period before other actions to reduce the deficit are completed.

5. Continue to press, in conjunction with the demand study, for the development of a supplemental source of water which will enable New York City to meet its future needs.

b. To Help Resolve Long Island Groundwater Quantity and Quality Issues:

1. DEC, in cooperation with the USGS and Nassau and Suffolk Counties, will maintain an island-wide hydrologic data base and an integrated data management system, incorporating the work currently being carried out by all involved agencies, in order to continually assess the affects of consumptive water use and changes in recharge throughout the region and including Queens County.

2. DEC, with assistance from the interested and affected local, state and federal agencies, will complete the development of specific criteria for quantity aspects of the region's water resources, particularly for the determination of safe yield based upon consideration of significant parameters.

3. DEC, DOH, USGS and Nassau and Suffolk Counties will develop a comprehensive ground and surface water monitoring system that is responsive to the development of specific water quality criteria and the need for information on groundwater depletion.

4. DEC will continue to implement the "cap" program by enforcement of pumpage limitations and related water conservation requirements for Nassau County water suppliers and for the Jamaica Water Supply Company.

5. DEC will continue to require water conservation plans of all Nassau County water suppliers and will require conservation plans as part of all Long Island well permit applications.

6. DEC, USGS and Nassau County will make additional investigations to improve their working knowledge of the hydrology, yields and saltwater interface of the Lloyd and Magothy Aquifers in Nassau County. Future adjustments in the current moratorium on well permits in the Lloyd aquifer will be considered based on this knowledge.

7. DEC will conduct annual management level meetings of all key regulatory agencies to review the Long Island Groundwater Management Program implementation, problems, priorities and program resource deployment.

8. Agencies will continue to implement recommendations of the Long Island Groundwater Management Program (DEC, 1986) in order to protect and preserve the groundwater quantity and quality in the region and to coordinate monitoring activities.

Table V-2 - Estimated Annual State Agency Costs of Strategy Implementation Plan, Immediate Actions 1989-1991

ACTION

1. Additional State Actions on Water Quantity

a. New State Legislation	Annual Cost $
a. Registration of water withdrawals	$ 60,000
b. Permits for large diversions and consumptive uses	120,000
c. Universal metering	60,000
d. Registration of well drillers	Existing Resources
SUBTOTAL	$240,000

b. Expanded State Water Conservation Program	
a. System water conservation plans	$ 60,000
b. Technical assistance on leakage control	60,000
c. Comprehensive public information and education programs	60,000
d. Evaluation of state low flow fixtures law	10,000
SUBTOTAL	$190,000

c. Expanded Instream Flow Management Program	
a. Minimum flow policy adoption	Existing Resources
b. Minimum flow criteria	Included in Item C
c. Review operation of existing impoundments	$120,000
SUBTOTAL	$120,000

2. Additional State Actions on Water Quality

a. Pollution control, environmental management, standards and classifications	Existing Resources
b. Drinking water standards	$ 30,000
c. Watershed rules and regulations	90,000
d. Filtration of surface water supplies	210,000
e. Treatment of groundwater supplies	210,000
SUBTOTAL	$540,000

	Annual Cost $
3. Additional State Assistance on Water Supply System Management	
a. Uniform accounting procedures, determine true cost of water, etc.	$ 30,000
b. Special needs of small water systems	60,000
c. Water supply system planning	180,000
d. Comprehensive planning for strategy updating	300,000
SUBTOTAL	$570,000
4. New State Program of Water Supply System Improvement	
a. Detailed system studies and capital expansion and improvement plans	$2,000,000 4-year local assistance program
b. Capital reserve fund for low interest loans	
5. Integrated and Expanded State Water Data Program	
a. Intergration, coordination, expanded data base	$ 120,000
b. Data management system in Great Lakes Basin	250,000
c. Expanded cooperative program with USGS	250,000
d. Upstate well registration	120,000
e. Agricultural water use data	120,000
f. Dependable yield criteria and methodology	30,000
g. Supplemental irrigation water use	120,000
SUBTOTAL	$1,010,000
6. New Long-Term Water Research Program	
a. Research agenda	$200,000
7. Expanded Public Information, Education and Involvement Program	
a. Continuation of existing programs, increased coordination, new initiatives and materials	$60,000
8. Major Regional Program	
a. State Actions on New York City Water Supply	
a. Water conservation and metering programs	Existing resources

	Annual Cost $
b. Impacts of water conservation and metering	$30,000
c. Mayor's Intergovernmental Task Force	30,000
d. Contingency plans	Existing resources
SUBTOTAL	$60,000

b. State Actions on Long Island Groundwater Quantity and Quality

a. Hydrologic data base and integrated data management system	Cost estimate included in the Long Island Groundwater Management Program
b. Criteria for quantity aspects	
c. Comprehensive ground and surface water monitoring system	
d. "Cap" program	
e. Water conservation plans	
f. Investigations of Lloyd and Magothy Aquifers	
g. Annual management level meetings on Long Island Groundwater Management Program	
h. Continuing implementation of Long Island Groundwater Management Program recommendations	

C. Strategy Revision

The water resources management strategy must be reviewed at least once every two years and, if necessary, amended. Although major effort went into preparation of this strategy, the need for review and revision is obvious from the listing of data and research needs and recommendations for additional investigations and studies (Chapter III). In addition to incorporating new information, the strategy needs to be updated periodically to reflect results of ongoing activities and changes which may occur. Finally, the strategy does not respond to all elements of the Water Resources Planning Council's criteria for evaluation, and these omissions should be given priority attention during the revision process.

To respond to these needs, a large number of additional activities will need to be completed during the two-year period, 1989-1990, inclusive, to complete the first strategy revision by January 1, 1991. These activities are described in the following. In addition to these special efforts, the revised strategy should indicate the progress made on recommended actions and reflect their updated status.

1. Water Resources Planning Council

The Council has provided guidance to DEC and DOH in the development of the substate and statewide strategy and will continue to do so in the future on the updating of the strategies. The Council has also identified some activities which should be carried out by the Council.

a. Review of DEC and DOH responsibilities in Public Water Supply Program

DEC and DOH both have responsibilities in the state water supply program. There are some overlapping responsibilities and in some cases inconsistency between two agencies. There is a need for the Council to make a detail review of the two agency responsibilities and make recommendations to improve the administration of the state water supply program.

b. Re-evaluation of Council Criteria

The Council has developed the criteria for evaluation of the substate and statewide strategies. Based on the review and actions of the Council on the strategies, there is a need to re-evaluate and modify the criteria as necessary.

c. Council Responsibilities in Strategy Implementation

The Water Resources Management Act of 1984 does not clearly describe the Council responsibilities in implementation of the statewide water resources management strategy. The Council will review the legislation and make recommendations to modify it.

d. Water Allocation Use Stress Condition

The Council will consider systems and criteria for the allocation of water under stress conditions, including preparation of a study bill (water supply vs. fisheries vs. power development vs. industry, etc.).

Some very basic elements of a decision tree exist now (water supply as a priority use) but are not sufficient to resolve complicated instances of competing demands for water from the same source at critical times.

e. Promotion of Strategy Recommendations

The Water Resources Planning Council will promote the recommendations of the statewide strategy, working especially with state legislative leaders and key county and local officials, proposing or negotiating revisions where appropriate and necessary.

2. Department of Environmental Conservation

a. Substate Region Boundary

The boundaries of the 13 substate regions will be re-evaluated and modified as necessary. Consideration will be given to combine some of the upstate regions.

b. Planning Period

The water demand projections will be extended to 50 years as specified in the Council criteria. DEC, with assistance from the Department of Economic Development, would have to make population projections to 2040 and make water demand projections.

c. Safe Yield Estimates and Forecasts

Safe yield of major surface water and ground water resources will be estimated, and guidelines will be developed to deal with the long-term forecasting of safe yield (to correspond with the long-term forecasting of demand, to 2040) to take into account uncertainties relating to changes in climate, atmospheric chemistry, and sea level.

d. Water Use Estimates and Forecasts and Instream Flow Criteria

Major water uses by self-supply industries, commercial users, institution, will be estimated and forecast, and criteria for instream flow will be reviewed in relation to waste assimilation, fishery management, power generation, recreation and navigation requirements.

e. Risk Assessment and Management

Study will be made to investigate parameters that effect acceptable risk in public water supply systems, and to develop guidelines and procedures for in a public water supply system, relating to quantity, quality, and infrastructure failure risk assessment and management.

f. Council Criteria

Additional work needed to meet the Council criteria will be carried out. This work will be specified by the Council when it takes actions on the substate and statewide strategies.

g. Coordination of Water Resource Activities

Alternative mechanisms and procedures will be developed to provide continued coordination of water resource activities in the state. The Water Resource Planning Council can also play the role of coordination.

h. Critical Water Management Areas

DEC will develop a statewide list of critical water management areas, including:

- Significant quantity - stressed sources;

- Significant quality - stressed watersheds; and

3. Department of Health

a. Assist DEC in the activities described above.

b. Collect and analyze additional water supply system data of small water supply system to improve the data base.

c. Re-assess the water resource management goals and objectives.

d. Other work specified by the Council when it takes actions on substate and statewide strategies.

4. Department of Agriculture and Market (and Others)

a. Estimate agricultural water needs including water needs for supplemental irrigation.

Table V-3. Implementation Plan for State Water Resources Management Strategy

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
A. Water Quantity					
1. Water Conservation					
a. Require each water supplier with a large system serving more than 5,000 people to prepare a water conservation plan as one element of their system management plan, which also should include a comprehensive emergency management plan.	H	DEC/DOH	1989+	0	Use existing resources.
b. Require each water supplier with a small system serving less than 5,000 people to prepare a water conservation plan, as a condition of each permit for an additional source of supply.	H	DEC/DOH	1989+	0	Use existing resources.

LEGEND

State - New York State
DEC - Department of Environmental Conservation
DOH - Department of Health
A&M - Department of Agriculture and Markets
DED - Department of Economic Development
DOS - Department of State
PSC - Public Service Commission
SEMO - State Emergency Management Office
CU - Cornell University
WRI - Water Resources Institute
A&C - Audit and Control (Office of State Comptroller)
WRPC - Water Resources Planning Council

NOTES:
H = High Priority
M = Medium Priority
L = Low Priority
Cost Assumptions: $60,000 per man year

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
c. Provide technical assistance to water suppliers on the preparation of water conservation plans, including development of model water conservation and emergency management plans and evaluations of specific water conservation measures.	M	DEC/DOH/PSC	1989+	$60,000	
d. Help water suppliers evaluate the benefits, reliability, and economic, environmental and social costs of water conservation measures in their conservation plans.	M	DEC/DOH/PSC	1989+	$60,000	
e. Establish clear guidelines on how to calculate and document water conservation savings and require each water supplier with a large system serving more than 5,000 people to report on such savings.	M	DEC	1989+	$30,000	
f. Provide technical assistance to water suppliers on leakage control, including provision of a team and/or equipment for leak detection surveys.	H	DEC/PSC	1989+	$60,000	
g. Require large water suppliers to file reports with the state that identify safe yield, unaccounted-for water, consumptive use, drought vulnerability, per capita water use and water use by type of customer; report annually to their customers on a range of water-related uses,	M	DOH/DEC/PSC	1989+	$30,000	

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
including water conservation; and use billing formats that highlight water use over certain periods in comparison with previous years.					
h. Provide guidelines for large water suppliers to establish water conservation goals.	M	DEC	1989+	$30,000	
i. Identify special problem areas that require particular attention for water conservation because of their critical balance between supply and demand.	H	DEC/DOH	1989+	$30,000	
j. Evaluate modifications of the state low flow fixtures law, including more stringent standards, feasibility of a fixture-labelling requirement, feasibility of retrofitting and additional enforcement procedures, including provisions for local enforcement.	H	DEC	1989-1990	$10,000	
k. Establish an irrigation technology program for agricultural food producers and home and recreational turf management.	H	A & M	1989+	$60,000	
l. Conduct a feasibility study on retrofitting water savings plumbing fixtures in state facilities.	H	OGS	1989+	$30,000	Cost for program development only.
m. Establish and maintain comprehensive public information and education programs on water	H	DEC/DOH	1989+	$60,000	

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
conservation, including preparation and distribution of informational materials and other means to encourage water conservation.					
n. Assist businesses, industries and institutions to reduce their water use by collecting, maintaining and disseminating technical information on water saving methods, such as equipment changes and recycling and reuse of process water, and by continuing to promote water audits, particularly for large industrial water users.	M	DEC/DED	1989+	$30,000	
o. Develop and establish comprehensive water conservation programs for local jurisdictions (county, town, city, village) based on special consideration of specific actions (see Chapter III).	H	Local Government	1989+	Cost estimate not available.	
2. New Water Supply Source Development					
a. Modify the state public water supply permit program to require water suppliers seeking to develop new sources to demonstrate that they:	H	DEC	1989	0	Use existing resources.
- have effective water conservation programs in place to reduce water demands;					

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
- are using existing sources as fully as is feasible for their operations;					
- have made any possible facility adjustments or expansions for the efficient delivery of water from existing sources;					
- will not place in jeopardy the other existing public or self-supplied services already provided by a portion of any new or expanded sources; and					
- have identified all existing and potential water supply sources.					
3. Registration of Major Water Supply Withdrawals					
Enact legislation requiring registration with DEC of any withdrawal of water exceeding 100,000 gallons per day during any 30-day period anywhere in the state.	H	State	1989	$60,000	
4. Large Diversions and Consumptive Uses					
Enact legislation establishing a DEC permit program to control large diversions and consumptive uses (more than 2 million gallons per day) from all New York drainage basins.	H	State	1989	$120,000	Cost of program administration.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
5. Additional Water Use Regulation					
Conduct a study to evaluate the need to establish permit programs or an allocation system for other uses in addition to public water supply.	M	DEC	1991-1992	$120,000	Total for 2-year consultant and staff effort.
6. Instream Flow Management					
a. Adopt state policy that flows in all streams, from source to mouth, shall not be reduced below minimums necessary to assure the protection of natural resources, maintain adequate water quality, quantity, assimilative capacity, recreation, agriculture, transportation, and power generation uses, while recognizing domestic water supply has the priority use of the state's water resources. This minimum flow policy would apply to all new impoundments, diversions and withdrawals, including withdrawals from primary and principal aquifers.	H	DEC	1989	0	Use existing resources.
b. Develop criteria for minimum flows to be applied to all waters of the state, based on natural stream hydrology with existing stream and river conditions.	H	DEC	1989-1991		Combined cost for $120,000 b,c,d and f.
c. Review the operation of all existing impoundments (meeting the thresholds of ECI 15-0503) to identify problems and opportunities to balance	M	DEC (in cooperation with other interested state agencies, author-	1989+	See b.	

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
competing uses through instream flow management while not significantly impairing the intended purpose of the impoundment. This includes evaluating the impacts on aquatic resources within the impoundment as well as downstream of the impoundment.		ities and public interest groups)			
d. Make recommendations for minimizing impacts of existing structures and impoundments on fish and wildlife resources and other instream uses. For existing impoundments with release control structures, recommendations should include regulation of the volume of water, rate and timing of release and the rate of change in release of the water.	M	DEC	1989+	See b.	
e. Investigate need for obtaining instream releases from existing facilities and propose new statutes for obtaining minimum releases if necessary, consistent with overall water resources needs.	L	DEC	1989	$10,000	One time cost of $10,000.
f. Require that new water intake structures be designed to minimize impingement and entrainment impacts to aquatic organisms and populations and that impacts of existing structures be reviewed during the license or permit renewal process and changed, if necessary.	L	DEC	1989+	See b.	

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
g. Review new dams, withdrawals and diversions, as well as requests to modify existing permits, in light of instream flow management needs and competing uses, and explore and implement alternatives to greatest extent possible to minimize environmental impacts.	M	DEC	1989+	0	Use existing resources.
7. Economic Development					
a. Help municipalities to use their available excess water supply capacity to promote economic development which takes advantage of available water supplies, and guide water-intensive development toward areas with readily available supplies without inhibiting other land related resources management objectives.	L	DED/A&M/DEC/DOS	1989+	0	Use existing resources.
b. Consider the availability of water when making local land use and economic development decisions.	M	Local Government	1989+	0	Use existing resources.
B. Water Quality					
1. Protection and Preservation of Water Supply Sources					
a. Continue to virorously enforce state pollution control laws.	H	DEC	Ongoing	0	Use existing resources.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
b. Continue to virogously enforce state drinking water laws and regulations.	H	DOH	Ongoing	0	Use existing resources.
c. Set priorities for environmental management programs, such as discharge permits, solid and hazardous waste disposal and hazardous site waste cleanup, to take into account water quality protection for water supply sources.	H	DEC	1989+	0	Use existing resources.
d. Ensure the state standards and classifications for surface water and groundwater are adequate to protect water supply sources.	H	DEC/DOH	1989+	$30,000	
e. Link compliance with discharge permits for sewage treatment plants to state assistance on operation and maintenance and disseminate information on permit violators to all concerned local entities.	M	DEC	1990	0	Use existing resources.
f. Take steps to ensure full implementation of the Federal and State sole source aquifer programs including the Incompatible Uses Law.	M	DEC	1989		Contingent upon state appropriation.
g. Provide technical assistance and information to local governments on protecting water supply sources.	M	DEC	1989+	$30,000	

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
h. Require continuous disinfection of wastewater tributary to sources of public water supplies through SPDES permits as necessary.	H	DEC	1989+	0	Use existing resources.
i. Ensure that state drinking water standards are stringent enough to protect public health and safety.	H	DOH	1989+	$30,000	
j. Issue final guidelines for watershed rules and regulations program, and require watershed rules and regulations for all water suppliers and develop a program for enforcement of approved watershed rules and regulations.	H	DOH/Local	1990-1995	$90,000	
k. Require water suppliers to report annually on water quality. All water suppliers serving more than 5000 people should report annually to their customers on issues affecting the water supply, including specific water quality data.	M	DOH	1989	0	Use existing resources.
l. Ensure that surface water, groundwater and drinking water standards are coordinated for consistency.	H	DEC/DOH	1989+	0	Use existing resources.
m. Identify priority areas for watershed protection, establish special standards for critical watershed protection areas.	M	DEC/DOH	1990-1992	$15,000	

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
n. Develop alternative methods for watershed protection, involving coordination among state programs for control of point and non-point sources, watershed rules and regulations, and protection of sole source aquifers and wellheads.	M	DEC/DOH	1990-1992	$15,000	
o. Adopt and aggressively apply watershed rules and regulations and land use controls to protect water supply sources including land acquisition program.	H	Local Government	1989+	0	Use existing resources.
2. Surface Water Treatment					
a. Consider mandating filtration of all surface water supplies and develop priorities for compliance.	H	DOH	Ongoing	$210,000	
b. Initiate efforts toward the construction of filtration facilities on all surface water supplies.	H	Local Government	Ongoing		Cost estimate not available.
3. Groundwater Treatment					
a. Continue the current level of monitoring treatment where existing Maximum Contaminant Levels are violated, and contamination response procedures when action levels, standards or guidelines are exceeded.	H	DOH	Ongoing	$30,000	

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
b. Require monitoring for regulated and unregulated contaminants.	H	DOH	1989+	$60,000	
c. Implement federal standards as adopted and promulgate and implement specific and generic state standards for organic chemicals.	H	DOH	1989+	$120,000	
C. Water Supply System Management					
1. Water Rates					
a. Establish uniform accounting procedures that will enable communities to exert better financial control over their water supply systems and thereby manage them more effectively, including a separate water account so that increases in water rates will not be used to maintain a level of subsidy of general fund operations.	H	DEC/DOH/PSC	1989+	$30,000	
b. Establish guidelines and audit procedures by which communities can determine the true cost of water including costs of both a water supply and sewerage where one utility provide both services.	H	DEC/A&C/PSC	1989	$30,000	
c. Condition the receipt of any state financial or technical assistance upon water suppliers charging the true cost of water in their area.	H	State	1989+	0	Use existing resources.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
d. Repeal the provision making water districts ineligible to accumulate capital reserve funds (which reduces their ability to set aside funds and plan for capital improvements).	H	State	1989	0	Use existing resources.
2. Water Metering					
a. Enact legislation to require universal metering of all public water supply systems in the state, including both service connections and production sources, and metering of major self-supplied water uses. Household wells would not be included. Self-supplied agricultural water users would not be metered, but would be incorporated within the comprehensive data via a representative sampling program.	H	State	1989	$60,000	
b. Maintain accurate records of water consumption by major categories, such as residential, commercial and industrial uses, so that rates and billings can be tied to use, and unaccounted-for water can be identified and corrected.	M	Water Suppliers	1989+		Cost estimate not available.
3. Supply Management					
Provide technical assistance to water suppliers on sound management of current supplies,	L	DEC/DOH	1989+	$60,000	

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
including measures for long term and emergency demand management, leakage, and waste control, operating rules, conjunctive management and public education and information.					
4. Small Water Systems					
a. Continue to place emphasis on the regulations of small water systems to improve the physical condition, operation, and management of small systems. (See Chapter III for details.)	H	DOH	1989+	$60,000	
b. Provide technical assistance to small water systems on source evaluations, dependable yield determination, assessment of future needs, leak detection, water conservation and other aspects related to water resources development and assurance of adequate water supply.	H	DEC	1989+	$60,000	
c. Continue the Self-Help Support System to assist small communities in using their own resources to alleviate local water supply problems.	H	DOS/DEC/DOH	Ongoing	$60,000	
d. Develop a computerized uniform data collection and reporting system, and provide training for small systems to improve their monitoring and management programs and to simplify meeting their reporting requirements.	H	DEC/DOH	1989+	$30,000	

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
e. Improve operation, maintenance, financing and management of small systems, and overcome limits of small systems by assisting small systems to join with others through measures such as regionalization, privatization or joint service contracts.	H	Localities	1989+	0	Use existing resources.
5. Regional Water Supply Systems and Interconnections					
a. Further identify opportunities for regional water supplies and for system interconnections.	M	DEC/DOH	1990	$60,000	
b. Make a more detailed assessment of impediments to regional water supplies and interconnections and identify alternative means of overcoming the impediments.	L	DEC/DOH	1990	$30,000	
c. Provide technical assistance to localities to investigate specific opportunities for regional water supplies and system interconnections.	M	DEC/DOH	1990+	$30,000	
d. Require interconnections between water supply systems for (1) permanent use to meet supply deficiencies where necessary and where technically, economically, and environmentally feasible and for (2) temporary use during emergencies such as drought or supply contamination.	L	DEC/DOH	1990+	0	Use existing resource.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
6. Water Supply Plans					
a. Require within the State Sanitary Code a large system serving more than 5,000 people to prepare a water supply management plan and update it periodically. (See Section III.C.6. for details.)	H	DOH	1989+	$60,000	
b. Develop a guidance manual for water system managers to prepare a water supply management plan and develop a pilot management plan.	H	DEC/DOH	1989	$60,000	
c. Provide technical and financial assistance to water suppliers for the preparation and implementation of water supply management plans.	M	DOH/DEC	1989+	$60,000	
d. Require community water suppliers to prepare and submit emergency plans for coordinated and effective responses to water supply contamination incidents in accordance with recent legislation requiring emergency plans at larger water systems.	M	DOH/DEC/SEMO	1989+	0	Use existing resources.
e. Encourage counties with significant water supply quantity problems to prepare county water supply management plans; county plans should utilize local and system plans.	M	DEC	1989+	0	Use existing resources.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
f. Ensure that water supply management plans prepared by water suppliers and counties are mutually consistent with this statewide strategy.	M	DEC/DOH	1989+	0	Use existing resources.
g. Conduct comprehensive water resources planning in preparation for revisions of the statewide and substate strategies. Such planning should be directed toward both site specific programs and projects and further development of substate strategies.	H	DEC/DOH	1989+	$1,000,000	
D. Water Supply System Improvement					
1. System Studies					
a. Establish a program to provide technical and financial assistance to municipal and investor-owned public water supply systems to complete detailed system studies of improvement needs and prepare capital expansion and improvement plans. (See Section II.D.1. for details.)	H	State	1989+	$2,000,000	Four-year local assistance program.
b. Develop uniform accounting procedures that will enable communities to exert better financial control over their water supply systems and thereby manage them more	H	DEC/DOH/PSC	1989	$30,000	

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
effectively; establish audit procedures by which communities can determine the "true cost" of water; and improve each community's ability to represent its needs for and its financial capacity to support capital projects that can rehabilitate, improve or expand existing water supply systems.					
c. Assist water suppliers to establish water service delivery goals based on state policies and local conditions, including risk analyses of service interruption, associated economic disruption and pressure fluctuations.	L	DOH/DEC/PSC	1989+	$30,000	
2. State Financing Incentive					
a. Establish a capital reserve fund to provide low interest revolving loans to water suppliers to improve water supply systems (See Section III.D.2. for details.)	H	State	1990		
b. Continue to seek and support federal technical and financial assistance for improvement of water supply systems. (See Section III.D.2. for details.)	H	State	1989+	0	Use existing resources.
c. Continue to establish local water authorities to obtain the capability for revenue bond financing and for other benefits provided by authorities.	M	Local Government	1989+	0	Use existing resources.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
E. Data and Research					
1. Water Resources Data Base					
Data Integration					
a. Integrate and coordinate state, federal and local agency programs relating to water resources data in order to facilitate data collection, storage, retrieval, and analysis.	H	DEC/DOH	1989+	$120,000	
b. Develop an expanded data base that will provide the character and quality of information required for sound water resources and water supply management.	H	DEC	1989+	$60,000	
c. Establish a comprehensive data collection and management system in the Great Lakes Basin in accordance with Great Lakes Charter.	H	State	1989+	$250,000	
Water Quantity Data					
a. Support the National Weather Service climatological data program and assist in obtaining improvements necessary to meet the state's water resources data needs.	H	State	1989+	0	Use existing resources.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
b. Expand the present cooperative program with USGS to obtain more comprehensive data on the state's surface and groundwater resources, provide for more data analysis and utilize the Geographic Information System (GIS) for resource data management.	M	DEC	1989+	$250,000	
c. Expand the current groundwater observation well network by establishing additional wells in those primary aquifers where they do not presently exist.	H	DEC/USGS	1990-1995		Cost estimate not available.
d. Complete the regional mapping or superficial (unconsolidated) aquifers across the entire state at a consistent scale and format.	H	DEC/USGS	Ongoing		Cost estimate not available.
e. Enact legislation to require the registration of well drillers in the state as now required for Long Island and to establish a Water Well Construction Code.	H	State	1989	0	Use existing resources.
f. Expand to additional upstate areas the well registration program presently established in the Upper Delaware River Basin through the Delaware River Basin Commission, requiring the submittal of well completion reports with essential data, in order to help determine the availability and use of groundwater statewide.	H	DEC	1989	$120,000	

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
Water Use Data					
a. Utilize the integrated standard data base that has been developed by the USGS for all water use data in the state and actively participate in the USGS program to develop a national report on water use every 5 years that includes reliable estimates for New York.	H	State	1989+	$30,000	
b. Require major self-supplied industrial, commercial, institutional and agricultural water users withdrawing an average of over 100,000 gallons per day during any 30-day period to file quarterly reports on monthly and maximum daily withdrawals.	H	DEC	1989	0	Use existing resources.
c. Develop improved estimates of present and of projected self-supplied industrial, commercial and institutional water uses, including smaller (less than 100,000 gallons per day) self-supplied uses.	H	DEC/DED/A&M/WRI	1989+	$150,000	Includes monitoring agricultural uses.
d. Establish an agricultural water need and use data research and monitoring system, including modeling and forecasting methods, to develop improved and reliable estimates of present and projected	H	State/CU/ A&M/WRI	1989+	$100-150,000	6-year program.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
agricultural water use, based on significant factors affecting water demands, for integration of such data with that of other water uses.					
e. Compile and integrate data on other water uses, such as power generation, navigation and recreation.	M	DEC	1989-1990	0	Use existing resources.
Water Supply System Data					
a. Specify methods of water system monitoring, surveillance and record-keeping and provide technical assistance to water suppliers to improve their data collection and reporting system to meet local and state needs.	H	DOH/DEC	1989+	$30,000	
b. Purchase and use micro-computers for their data collection and reporting system, where appropriate.	M	Water Suppliers	1989+		Cost estimate not available.
c. Provide a data program (including computer applications) and train water suppliers on use for their systems.	M	State	1990	$30,000	
d. Computerize key water supply system data in existing upstate public water supply permit files and Long Island well permit files.	M	DEC	1990+	$30,000	

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
Dependable Yield Data					
a. Establish uniform criteria and methodology for water suppliers to use for determining the dependable yield of surface and groundwater sources, and provide technical assistance to water suppliers for making these determinations.	M	DEC/DOH	1989	$30,000	
b. Use research findings to develop new or improved estimates of dependable yield of water supply sources by significant hydrologic units.	L	DEC	1989+	$30,000	
Facility Needs Data					
a. Help local water suppliers develop their capability to gather facility data and provide information to them on appropriate facility record-keeping.	M	DOH	1989+	$60,000	
b. Update and maintain water system maps and inventories and maintain appropriate data for facility maintenance, including records of main breaks, leakage, system tests, service connections and flows.	L	Water Suppliers	1989+		Cost estimate not available.
Environmental and Land Use Data					
a. Assure that all relevant environment and land use data are incorporated into water resource decisions.	L	DEC	1989	0	Use existing resources.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
b. Develop and use an integrated data management system (GIS) to geographically relate aquifer recharge to land use and in-stream requirements and existing and potential contamination to water uses and water supply needs.	M	DEC	1989+	0	Use existing resources.
Agricultural Supplemental Irrigation					
Evaluate the present extent as well as future potential of supplemental irrigation water use; identify factors affecting the promotion and adoption of more efficient methods of supplemental irrigation; and develop with state financing an ongoing supplemental irrigation technology program based on cooperative assignments with NYS Cooperative Extension, Cornell University, irrigators, irrigation suppliers and other organizations.	H	State	1989+	$175,000	Includes education component.
2. Water Resources Research					
a. Undertake a long-term research program that addresses the state's water resources management issues and problems in order to insure that these resources can be used for economic growth and development, and for preserving the quality of the environment.	H	WRI	1990+		Cost of program to be developed.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
b. Affirm the Water Resources Institute at Cornell University as the responsible agency for development of long-term program in consultation with other interests, and provide adequate funding for development and conduct of the program.	H	State	1989		Cost of program to be developed.
c. Establish a research agenda, based upon broad input and review, giving priority consideration to areas of research most needed for further development of the strategy. (See Section III.E.2.)	M	WRPC/WRI	1990	$200,000	
d. Consider joint research with other entities on problems of material concern. In particular, consider joint research with the Delaware River Basin Commission, New York City and other states in the Northeast. (See Section III.E.2.)	L	State	1990		Cost estimate not available.
F. Public Awareness, Education and Involvement					
a. Continue existing public education, awareness, information and/or participation programs but with a concerted effort to reach and actively involve the broader spectrum of water users.	H	DEC/DOH/Other State and Local Agencies	Ongoing		Use existing resources.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
b. Increase interagency coordination of programs and coordination with local government officials, water suppliers and other interested groups to develop comprehensive information, education, and participation activities on all water resources issues.	H	DEC/DOH/Other State	1989+	$60,000	
c. Develop new programs and informational materials to increase public awareness, education and involvement in all aspects of water resources management, through numerous activities. (See Section III.F.1.)	M	DEC/DOH/Other State	1989+	$60,000	
d. Increase coordination of information and education programs at the local level and with state agencies and interested groups and focus more on water resource issues.	H	Local	1989+		Cost estimate not available.
e. Develop new local programs and informational materials to increase public understanding and involvement, particularly in relation to local water needs, through activities similar to those of state agencies.	H	Local	1989+		Cost estimate not available.
A. Delaware-Lower Hudson Region					
1. New York City Water Supply Deficit					
a. Endorse New York City efforts to develop and implement comprehensive water conservation and metering programs.	H	DEC/DOH	Ongoing	0	Use existing resources.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
b. Continue the joint effort with New York City and other regional interests to conduct the detailed water demand study.	H	DEC/DOH	1988-1992		
c. Continue to participate in the evaluation of impacts of the water conservation and metering programs.	H	DEC/DOH	Ongoing	$30,000	
d. Participate on the Mayor's Intergovernmental Task Force to evaluate alternatives for long-term water supply.	H	DEC/DOH	Ongoing	$30,000	
e. Assist New York City in developing contingency plans for major droughts that may occur during the interim period before other actions to reduce the deficit are completed.	H	DEC/DOH	Ongoing	0	Use existing resources.
f. Continue to follow-up on recommendations in the second interim report (December 1987) of the Mayor s Intergovernmental Task Force for actions in an integrated program to reduce water demand and supplement the supply.	H	NYC	1988+		Cost estimate not available.
g. Participate in implementation of the statewide and Delaware-Lower Hudson Region water resources management strategies with particular reference to actions to reduce the water supply deficit for the city system.	H	NYC	1988+		Cost estimate not available.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
h. Initiate engineering feasibility studies of the Brooklyn-Queens Aquifer to confirm the quality and yield of the aquifer and determine its potential for use as an alternative to increasing the capacity of the Chelsea pumping stations.	H	NYC	1989-1990		Cost estimate not available.
i. Continue preliminary engineering planning for the possible development of Chelsea and alternative sites to determine the maximum potential capacity of the facilities acting as a supplemental supply and utilizing existing aqueducts. These detailed studies of the impact of continuously and nearly continuous (say 10 to 11 months per year) withdrawals at Chelsea and alternative sites should cover such topics as the salt front, chloride and sodium content of the blended supplies, anticipated safe yields of the supplemental supplies, effect of withdrawals on other systems using the Hudson River, etc. The studies should cover a range of withdrawals rates ranging from 100 to 300 mgd.	H	NYC	1990-1995		Cost estimate not available.
j. Implement planning for a supplemental supply as quickly as possible. If the current detailed water demand study indicates that the projected 2030 supply deficit is close to	H	NYC	1990-2010	$422 million	Cost for pump station expansions.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
the low end of the present estimated range of 300 to 800 mgd and the studies recommended it may be developed at Chelsea or an alternative site.					
k. Initiate long-term planning for an additional major water supply in excess of 300 mgd. Due to the present uncertainty of actual and projected water deficits for the New York City System, short-term and long-term planning which addresses the development of supplemental supplies is prudent and should be continued while concurrently working to establish more definitive deficit values. This planning activity should look at supply alternatives, demand management, water conservation, hydrologic and ecological impacts, the high flow skimming project and groundwater development in order to provide a thorough cost-benefit analysis of all viable supply options.	H	NYC	1990-2030		Cost estimate not available.
2. Regional Institutional Framework					
a. Create a regional water planning entity to address the long term needs of southeast New York. It should include representatives from the Hudson and Delaware Watersheds, New York City, Long Island, the Water Resources Planning Council and other interested municipalities.	H	WRPC/DEC/DOH/ Local Agencies	1989+		

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
b. Create countywide water agencies to have primary responsibility for procuring sufficient quantities of good quality water to supply wholesale to various small systems. They could provide technical help to small water systems on their operations and in developing water conservation plans.	H	Counties	1989+		
c. Undertake a planning effort that reviews water management and planning issues (refer to Section IV.A.2.). Provide this information to the regional planning entity for inclusion of this data into its planning activities and recommendations.	H	Counties	1900+		
d. Explore the creation of a regional institutional framework to address long-term supply requirements that may come from the planning process. This institutional framework would address the needs of all water users, both for those users inside the New York City system as well as those outside the system.	H	State/County/Local Agencies	1900+		
e. Explore the possibility of further expansion of the New York City System to accommodate regional growth pressures. This might provide the opportunity for efficient and economical distribution of	M	State/County/Local Agencies	1900+		

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
water to communities not currently served by the New York City System. The 1905 legislation should be reviewed to determine if new legislation is needed to facilitate development of new sources that may be beneficial to both the City and the upstate counties.					
B. Long Island Region					
1. Groundwater Quantity and Quality					
a. Maintain island-wide hydrologic data base and an integrated data management system incorporating the work currently being carried out by all involved agencies, in order to continually assess the affects of consumptive water use and changes in recharge throughout the region and including Queens County.	H	State/Counties/ USGS	1989+		Cost estimated included in the Long Island Groundwater Management Program.
b. Complete the development of specific criteria for quantity aspects of the region's water resources, particularly for the determination of aquifer yield based upon consideration of significant parameters.	H	DEC/Local/State/ Federal	1989+		
c. Identify present or future water quantity shortfall areas, and develop specific plans to decrease consumptive water use in the affected areas.	H	DEC/Counties	1989+		

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
d. Develop a comprehensive ground and surface water monitoring system that is responsive to the development of specific water quality criteria and the need for information on groundwater depletion.	H	DEC/DOH/USGS/ Counties	1989+		
e. Continue to enforce the pumpage limitations and related water conservation requirements for Nassau County water suppliers and for the Jamaica Water Supply Company, with necessary adjustments as conditions and new information warrant.	H	DEC	1988+		
f. Continue to require water conservation plans of all Nassau County water suppliers and require conservation plans as part of all Long Island well permit applications.	H	DEC	Ongoing		
g. Make additional investigations to improve working knowledge of the hydrology, yields and saltwater interface of the Lloyd and Magothy Aquifers in Nassau County. Consider future adjustments in the current moratorium on well permits in the Lloyd aquifer based on this knowledge.	H	DEC/USGS Nassau Co.	Ongoing		

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
h. Conduct annual management level meetings of all key regulatory agencies to review the Long Island Groundwater Management Program implementation, problems, priorities and program resource deployment.	H	DEC	1989+		
i. Implement site-as-a-system management in areas of industrial and commercial activities that involve existing or potential groundwater contamination by synthetic organic chemcials.	M	DEC	1990+		
j. Update and make final the draft Master Water Plan for Nassau County to provide a clear framework for county water resource management activities. The plan should give priority to water conservation to provide sufficient water supply in areas with present and projected quantity shortfalls.	H	Nassau Co.	1988-1990		
k. Conduct more detailed studies, including environmental impacts, for development of the intra-county transmission system, as proposed by the draft Nassau County Master Plan.	H	Nassau County	1988-1990		
l. Implement the recommendations of the Suffolk County Water Resources Management Plan to help insure continued water supply within the county.	H	Suffolk County	1988+		Total cost of $16,000,000. Use as framework for detailed engineering, management approaches.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
m. Continue efforts to extend service into areas presently not served, particularly areas experiencing contamination of private wells and those proposed by the Suffolk County Comprehensive Management Plan for transmission main extension.	H	Suffolk County Water Authority	Ongoing		
n. Implement additional water conservation measures in areas where supply is a major concern, including all of Nassau County and the insular areas of Suffolk County.	H	Local Governments/ Water Suppliers	1989+		
o. Continue to implement the recommendations of the Long Island Groundwater Management Program (DEC, 1986) in order to protect and preserve the groundwater quality in the region and to coordinate monitoring activities. The Long Island Coordinating Council should meet on a regular basis.	H	DEC/DOH/All Agencies	Ongoing		
C. Major Inter-Region Water Management					
1. Conjunctive Management					
a. Investigate in detail all aspects of conjunctive management of New York City water supplies and Long Island groundwater and develop a definitive recommendation on the feasibility of this option for inter-region water management.	H	State/NYC/Federal Agencies	1989+		Cost estimate not available.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
D. Upstate Groundwater Management					
1. Quantity and Quality					
a. Maintain the existing 6NYCRR Part 703, Groundwater Classifications, Quality Standards and Effluent Standards, as part of the State's Groundwater Management Program, to support the policy objective that all fresh groundwaters in the state will be preserved for the best usage as potable water.	H	State	Ongoing	0	Use existing resources.
b. Continue efforts to establish sound and defensible standards for both drinking water and ambient water quality and to reconcile any inconsistencies that may exist.	H	DEC/DOH	Ongoing	0	Use existing resources.
c. Consider reclassification of surface water segments supplying adjacent public water supply wells.	H	DEC	1989+	0	Use existing resources.
d. Use the following priority system to geographically target groundwater management policies and activities in the upstate area: - Public water supply wellhead areas. - Primary water supply aquifer areas.	H	State	1988+	0	Use existing resources.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
- Principal aquifer areas.					
- Other areas.					
e. Use the following additional geographic categories where appropriate to further tailor programs to specific local conditions:	H	State	1988+	0	Use existing resources.
- Identified critical recharge areas within primary aquifer areas.					
- Identified special groundwater management areas within primary aquifer areas.					
- Other areas hydrogeologically tributory to primary or principal aquifer areas.					
f. Require, through the public water supply permit program, that all upstate public water supplies using more than 100,000 gallons per day from groundwater define the wellhead areas of their supply wells, and identify and disseminate information on appropriate methods which can be used for such definition.	H	DEC	1989+	$60,000	
g. Evaluate the scope of rural drinking water problems, which are related primarily to groundwater sources and potential alternatives for state action.	H	DEC/DOH	1990	$320,000	Total cost of evaluation.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
h. Implement a pollution source-oriented monitoring program for sensitive groundwater aquifers (primary and principal) through use of existing regulatory permit mechanisms.	H	DEC	1990		Cost estimate not available.
i. Maintain public water supply monitoring requirements and emphasize surveillance for organics in locations where potential organics sources are prevalent.	H	DOH	1988+	$280,000	Includes computer and laboratory services; monitoring by water suppliers with spot checks.
j. Maintain a groundwater problem inventory for use in program performance assessment, priority setting, and refinement of programs.	H	DEC	1988+	$30,000	
k. Maintain the Public Water Supply Well Closure List for the important information it provides on major groundwater contamination incidents and as a valuable management tool in determining program priorities.	H	DOH	1988+	0	Use existing resources.
l. Amend the Incompatible Uses Law to add 15 upstate aquifers as primary aquifers, and implement the law.	H	State/DEC	1989		Cost estimate not available.
m. Undertake two pilot study efforts to evaluate the effectiveness and costs of Site-as-a-System Industrial Facility Management in separate upstate primary water supply aquifers.	M	DEC	1990	$60,000	

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
n. Encourage local governments to develop critical area protection programs for primary public water supply aquifers and principal aquifers within their local jurisdictions; tailor local critical area protection programs to local conditions and needs.	H	DEC/DOH	1989+	0	Use existing resources.
o. Develop a technical guidance manual for local government on land use controls to assist in protecting sensitive groundwater areas. This guidance manual will provide specific technical guidance on planning processes and zoning applications under New York's zoning enabling statutes.	M	DEC/DOS	1990+	$60,000	
p. Aggressively pursue effective watershed rules and regulations for all public water supply wellhead areas, including the development of guidelines on use of watershed rules and regulations to complement other elements of a local groundwater area protection program.	M	DOH	1989+	$130,000	
q. Maintain an adequate, balanced groundwater contamination response capability.	H	DEC/DOH	1989+		Cost estimate not available.
r. Continue to implement recommendations of the Upstate Groundwater management Program.	H	DEC/DOH All Agencies	Ongoing		Cost estimate not available.

Recommended Action	Priority	Lead Agency/ Assisting Agency	Time Frame	Estimated Annual Cost	Notes
s. Revise the Petroleum Bulk Storage regulations to achieve equavalency with the Federal underground storage tank regulations Legislative authority to achieve the objective should be pursued.	H	DEC	1989+		Use existing resources.
t. Amend Article 40 of the ECL (Hazardous Substances Bulk Storage Law) to provide DEC with authority to regulate drum storage sites, where aggregate storage exceeds 250 gallons.	M	State	1989+		Use existing resources.
u. Prepare technical guidance manual on proper storage and handling of hazardous substances. The manual should focus on engineering practices for preventing leaks, spills and chemical accidents which could cause a release to the environment.	M	DEC	1990+	$120,000	

Appendix A

1984 SESSION LAWS

Chapter 509

ENVIRONMENT--WATER RESOURCES MANAGEMENT STRATEGY

An ACT to amend the environmental conservation law, in relation to providing for water resources management strategy.

Approved and effective July 24, 1984.

The People of the State of New YOrk, represented in Senate and Assembly, do enact as follows:

Section 1. Article fifteen of the environmental conservation law is § 1 amended by adding a new title twenty-nine to read as follows:

TITLE 29

WATER RESOURCES MANAGEMENT STRATEGY

§15-2901. Water resources planning council; organization.
There is hereby established within the department of environmental conservation a water resources planning council. It shall consist of fifteen members, including the commissioners of agriculture and markets commerce, energy, environmental conservation, health, transportation, the chairman of the public service commission, secretary of state and seven members to be appointed by the Governor including at least one member who shall have expertise in the science of water resources planning and at least one member selected from a list proposed by public interest or environmental citizens organizations. These seven members hall serve terms of four years each. Two of the members shall be appointed upon the recommendation of the majority leader of the senate and two of the members shall be appointed upon the recommendation of the speaker of the assembly. The governor shall select a chairman from among the members. Meetings of the council shall be called by the chairman. Members shall receive reimbursement for expenses.

§15-2903. Water resources planning council; quorum, bylaws.
A majority of the members of the council shall constitute a quorum for the transaction of any business or the exercise of any power of the council. The council may also establish for itself bylaws for the conduct of its affairs.

§15-2905. Statewide inventory of existing significant deficiencies in water supply systems.

The commissioner, in consultation with the commissioner of health and utilizing information requested from the responsible local officials as well as relevant information developed through titles eleven and thirteen of this article, shall cause to be prepared an inventory of existing significant deficiencies in water supply availability throughout the state, including specific needs for improvement, rehabilitation and establishment of water supply, distribution and transmission facilities. Such inventory shall also identify those water supply systems affected or threatened by intrusions of hazardous materials or wastes and the nature of remediation required. Such inventory shall be completed and transmitted to the governor, legislature and the council by July first, nineteen hundred eighty-five.

The commissioner in consultation with the secretary of state, shall also cause to be prepared a review and summary of existing statutory and constitutional provisions relating to the provision and financing of water supply facilities by local governments, including such provision and financing through inter-local cooperation. Such review and summary shall also identify and existing statutory and constitutional constraints against the effective and efficient provision of sound financing, on a revenue or general obligation basis, of such facilities. Such review and summary shall be completed and transmitted to the governor, legislature and the council by January first, nineteen hundred eighty-six. At such time based upon the above inventory and review and summary, the commissioner shall also cause to be prepared a compilation of those instances in which correction of existing significant deficiencies appears to be beyond the reasonable financial capabilities of the affected communities.

§15-2907. Water resources management strategy; development purpose.

Not later than January first, nineteen hundred eighty-seven, the department of environmental conservation, with the participation of the department of health and whenever possible, regional planning and development boards, shall develop and submit a complete statewide water resources management strategy to the water resources planning council for its review and adoption. This strategy shall be composed of substate water resources management strategies which recognize the natural boundaries of the water resource basins, watersheds, and aquifers and existing significant deficiencies of water supply, and which organize these in the most practical and manageable manner. Each substate management strategy shall analyze the present and future demographic, natural resource, economic development, water quality, and conservation requirements of public and private water systems and develop regional management strategies to meet the water resources requirements of residentia', agricultural, industrial and commercial users as well as assure the highest possible quality and quantity of these resources.

Strategies hall analyze the efficiency and capacity of existing water supply sources and facilities and shall contain recommendations for appropriate modifications, restoration, and expansion or development of new sources or facilities. The strategy shall also contain recommendations regarding implementation of these strategies by the department of health, the department of environmental conservation, other appropriate state agencies, local governments and special districts.

In addition, the departments shall submit to the council substate water resources management strategies as soon as such strategies are developed. The departments shall also report regularly to the council on the development of the strategies and receive the council's recommendations and directions. Such substate strategies shall also be available for public inspection as soon as such strategies are developed.

§15-2909. Water resources management strategy; hearings.
Upon receipt of the statewide water resources management strategy from the department of environmental conservation, the council shall promptly publish one a week for three consecutive weeks in newspapers of general circulation notice of public hearings thereon. Public hearings shall be conducted in each of the substate areas represented in the statewide strategy, and shall be in accordance with regulations adopted by the department, subject to modification by the council Such regulations shall, at a minimum, require a hearing on the record with sworn witnesses and shall afford interested parties a reasonable opportunity to sponsor witnesses and to question witnesses sponsored by others, including department staff, consistent with the need to conclude the hearings expeditiously so that a state water resources management strategy can be adopted in a timely manner. The hearings shall not be considered part of an adjudicatory proceeding, as defined in subdivision three of section one hundred two of the state administrative procedure act, or as part of a rule-making proceeding held under subdivision one of section two hundred two of such act.

§15-2911. Water resources management strategy; approval.
The water resources planning council shall, as expeditiously as practicable following the conclusion of its hearings, but in no case later that January first, nineteen hundred eighty-eight, determine, based on the record, whether the statewide water resources management strategy should be approved with modifications or disapproved, and shall state in writing the reasons for its determination. If the council has determined approval of the strategy, it shall be adopted by the departments of health and environmental conservation and other appropriate state agencies in the form determined by the council. If the council has determined disapproval of the strategy, the department of environmental conservation, in conjunction with the department of health, shall modify the strategy in accordance with the determination issued by the council and resubmit the strategy to the council for its action.

§15-2913. Water resources management strategy; revision.
From time to time and at least once every two years, the department of environmental conservation, with the participation of the department of health and whenever possible, regional planning and development boards shall review the strategy and shall either (a) prepare any amendments necessary to update the strategy, or (b) issue a determination that no amendments are necessary and the reasons supporting the determination. Any interested person may seek such a review upon written application to the department of environmental conservation for an amendment to the statewide water resources management strategy. Any statement issued by the departments that no amendments are necessary shall be submitted to the council for approval, modification or disapproval. Amendments shall be adopted in the same manner as the strategy itself.
This act shall take effect immediately.

Appendix B. Overview of Existing Water Management Institutions and Programs

A. State Agencies

A number of state agencies have authorities and responsibilities relating to water supply and water resource management. The three agencies with the most direct responsibilities are the Department of Environmental Conservation (DEC), the Department of Health (DOH) and the Public Service Commission (PSC). An overview of significant DEC, DOH, and PSC statutory authorities is shown in Table B-1.

1. Department of Environmental Conservation

DEC is the state's environmental agency with responsibility for administering a broad range of environmental quality and natural resource programs. The department's functions, powers, duties and responsibilities are set forth in the Environmental Conservation Law. In effect, DEC is the designated custodian of the state's natural resources, including water in the environment.

Water Supply

DEC's general responsibilities for water resources are set forth in Titles 1 and 3 of Article 15. The department has broad general jurisdiction, as defined by Section 15-0109:

"The department shall exercise its powers and perform its duties in any matter affecting the construction of improvements to or developments of water resources for the public health, safety or welfare, including but not limited to the supply of potable waters for the various municipalities and inhabitants thereof, the use of water for industrial and agricultural operations, the developed and undeveloped water power of the state, the facilitation of proper drainage and the regulation of flow and improvement of the rivers of the state."

Subsequent parts of Article 15 establish specific DEC water resource programs relating to water supply that build upon this general jurisdiction. These include:

- Regulation of the acquisition, conservation, development, use and distribution of water for potable purposes, for the irrigation of agricultural lands, or certain multi-purpose projects (Sections 15-1501 and 15-1503);
- Regulation of water supply to other states (Section 15-1506);
- Regulation of transport of water by vessel (Section 15-1506);
- Registration of well drillers and regulation of certain wells in Long Island counties (Sections 15-1525 and 15-1527);

- Regulation of dam construction and provisions for dam safety inspection and correction of unsafe conditions, including water supply dams (Sections 15-0503, 15-0507, 15-0511);

- Regulation of reservoir releases, including large water supply reservoirs in certain southeastern counties (Title 8).

- Development of a water resources management strategy (Title 29);

Article 15 also contains provisions for other water programs which are no longer active. These include:

- River regulation by storage reservoirs (Titles 21, 23, and 25);

- Local and regional water resources planning and development (Title 11).

- Comprehensive public water supply studies and reports, conducted by the Department of Health (Title 13).

DEC is authorized to conduct other important activities for the discharge of its duties, including the following:

- Surveys and investigations, inspections and establishment of reporting requirements;

- Continuing investigations of water resources of the state to accumulate comprehensive data as a basis for providing for their conservation, development, regulation and use;

- Systematic gauging of rainfall and stream flow throughout the state.

Finally, DEC has major responsibilities with regard to relations with other governmental bodies and agencies. In order to adequately protect the interests of the state, DEC is authorized to:

a. "Cooperate with the appropriate agencies of the federal government or this or other states, or any interstate bureau, group, division, or agency with respect to use of water from lakes, ponds, rivers and streams, which are without or wholly or partially contained within this state, and to endeavor to harmonize any conflicting claims which might arise therefrom."

b. "Appear, represent and act for the state in respect to any proceeding before either a federal or state governmental body or agency where the water resources of the state may be affect ..."

c. "Present for the consideration of the Congress of officers of the federal government, as occasion requires, the just rights of the state in relation to its waters ..."

DEC is also designated as the agent of the state to obtain the cooperation, aid and assistance of any appropriate federal agencies in the performance of the functions of the department.

Water Quality

DEC is responsible for the maintenance of reasonable standards of purity of the waters of the state and for the prevention and control of water pollution. Article 17, ECL, Title 3, gives the department authority to classify the waters of the state and adopt standards of water purity. Title 8 establishes the State Pollutant Discharge Elimination System (SPDES) permit program which established limitations of effluent discharges.

Major elements of the department's water quality program include water quality standards and classifications, water quality monitoring and surveillance, municipal and industrial wastewater discharge permits (SPDES), and programs for the development, operation and maintenance of municipal wastewater facilities.

Several other programs administered by the DEC are responsible for regulating important potential sources of contamination of water resources. Principal among these are programs in the areas of solid and hazardous waste, including solid and hazardous waste facilities regulation; permitting of industrial waste transport; State Superfund (relating to abandoned hazardous waste site remediation); and hazardous waste enforcement. Other DEC administered programs which have important relationships to water resources management include those in the areas of pesticides, mineral resources, and oil and gas regulation.

2. Department of Health

The Department of Health, is responsible generally for the protection of public health and more particularly to assure a safe potable supply of drinking water for the state's citizens. Generally, DOH is responsible for water which has been withdrawn by public water suppliers for distribution to the consumer.

Under the New York State Public Health Law and Part 5 of the State Sanitary Code, DOH administers a major program to assure that all public water supply systems in the state are properly operated and maintained and that all consumers are assured delivery of a safe and adequate supply of water. This program includes regulation of public water supply facility design and construction; periodic monitoring of the quality of waters delivered to the tap; periodic inspection, surveillance, and evaluation of all public water systems; certification of water system operations; emergency response; laboratory services; establishment and enforcement of state drinking water standards and minimum treatment requirements; and the enactment and enforcement of watershed rules and regulations.

The DOH evaluates available health effects data and establishes appropriate drinking water standards and/or guidelines. DOH drinking water standards and guidelines are also utilized by the DEC as a basis for establishing effluent limitations for point source wastewater discharges under the SPDES program.

Because public water supply is the predominant and most important use of water resource in New York State, the Department of Health has a very strong policy level involvement in water resource-related matters, in addition to its specific water supply program responsibilities.

3. Public Service Commission

The Department of Public Service's Public Service Commission (PSC) has broad regulatory authority over the furnishing or distribution of water for domestic, commercial or public uses by private and investor-owned water supply systems. Its jurisdiction covers rates, charges, rules and regulations for water service, and the issuance of various forms of securities and service. Department staff review books and records of water works corporations, study original costs of property, estimate depreciation, and study and make recommendations on rates and charges. They inspect and test water plant facilities and equipment for safe and adequate service, conduct engineering studies of efficiency and operation, study water conservation and metering, investigate complaints and inspect for compliance with commission orders. They also advise water works corporations on operation and rate problems.

4. Other State Agencies

Other state agencies have roles and responsibilities which form parts of the state's current program for water resources management or could provide important elements in the future.

The Environmental Facilities Corporation (EFC) is a public benefit corporation established for the purposes of planning, financing, constructing, maintaining and operating of environmental facilities. The EFC may assist municipalities, state agencies or individuals. Water management facilities that may be planned, designed, and constructed by EFC, on a turnkey basis, include ground and surface water supplies, water treatment plants, transmission and distribution systems, underground and elevated storage facilities, pumping stations and reservoirs, dams and other impoundments. The provision for impoundments was by amendment to the Public Authorities Law in 1984. The EFC is also empowered to finance water management facilities by issuing negotiable bonds and notes and may assist private water companies on tax exempt financing.

The Department of Transportation is responsible for planning, constructing, and maintaining waterways, including operation and maintenance of the state barge canal system. The 524-mile system includes significant reservoirs and channels which supply water for operating the canals.

The Department of Audit and Control has authority over the finances of the various units of local governments, including municipal water systems.

Permission of the state Comptroller must be obtained if town water and water supply districts, town water storage and distribution districts, and town improvement districts are to be created or expanded. The department may indirectly regulate water rates charged by county and town districts by assuring that they comply with the law that provides that their revenues be equal to the costs incurred. The department of Audit and Control has no authority to regulate municipal water rates.

The Department of Commerce promotes industrial expansion, commercial activity, recreation and tourism within the state. Water resources management is an important consideration in the department's program since an adequate water supply is one of the prime requirements for a favorable industrial site and many commercial enterprises.

The Department of Agriculture and Markets has a strong interest in water resources management as it oversees the production, processing and distribution of the state's agricultural products. The department's concern includes both quality and quantity aspects of water supply and use for various agricultural purposes.

The New York State Soil and Water Conservation Committee oversees the Soil and Water Conservation Districts program for the State, coterminous with 57 counties. The State Committee and the districts have specific responsibilities for water quality and quantity matters. The State Committee and the districts are directly involved in the combined development, with DEC, of the State Non-Point Pollution Control Program and are responsible of its implementation as well as for watershed resource management assistance on individual and multiple landowner conservation systems.

The Office for Local Government in the Department of State helps local governments to develop more effective services by securing assistance from other state agencies and the federal government. It acts as a clearing house for information and studies problems common to many local governments, including the improvement of water supply facilities.

The Office of Parks, Recreation and Historic preservation is responsible for statewide policies and plans for recreational facilities. Since many facilities are water-related, the office has a strong interest in water resources management.

While responsibilities relating to water resources management are shared by a number of state agencies, the bulk of the responsibility on public water supply systems is concentrated within DEC and DOH. These two agencies have the most direct involvement at the policy level and in program administration and are co-equal partners in providing direction for the state's water supply program in the future.

TABLE B-1

Overview of NYSDEC/NYSDOH/PSC
Statutory Authority Relating
to Water Resources

LEGISLATION	COVERAGE
ECL, Article 15 Water Resources	Provides the DEC broad authority to regulate and manage the water resources within the state. Provides for public water supply permits, comprehensive water resources planning, and such studies as may be necessary to provide for the proper conservation, development, regulation, and use of the water resource.
ECL, Article 17 Water Pollution Control	Authorizes the Commissioner to promulgate rules and regulations required, to prevent pollution of the waters of the state, to provide for the measuring of the effect of discharges to water, and to establish a water quality surveillance network to meet the needs of the state. Includes the statutory authority for both the SPDES permit program and water quality classifications and standards.
ECL, Article 27 Collection, Treatment and Disposal of Refuse and Waste	Authorizes DEC to promulgate regulations to prevent pollution caused by hazardous and non-hazardous wastes. Encompasses the transfer, processing, recovery, reclamation, and disposal of solid wastes, and also includes measures addressing both active and inactive waste disposal sites.
ECL Articles 23, 33	Provide for other programs which contribute to protection of water resources, including the Oil Spill Prevention, Control and Compensation Program, the Mined Land Program and Gas and Oil Regulatory Program, and the State Pesticide Regulatory Program.
PHL, Article 11 Public Water Supplies, Sewerage, and Sewage Control	Authorizes the Commissioner of Health to promulgate rules and regulations to protect public water supplies from contamination.

TABLE B-1

Overview of NYSDEC/NYSDOH/PSC
Statutory Authority Relating
to Water Resources

(Continued)

PHL, Article 2 §201 (1m) Functions, Powers and Duties of the Department	Authorizes the Department of Health to supervise and regulate the sanitary aspects of water supply, sewage disposal and control and pollution of state waters.
PHL, Article 2, §225.4	Prescribes that the Sanitary Code may deal with any matters affecting the security of life and health or the preservation and improvement of public health in the State of New York.
PSC, Article	Authorizes the PSC to regulate supply and distribution of water for domestic, commercial or public uses by private and investor-owned water supply systems.

B. Regional and Local Agencies

1. Region Planning Agencies

Regional planning agencies have been established in many areas of New York State, including most of the areas which contain large urban centers and/or major water supply systems. These agencies provide technical assistance and consultation services to county and other local governments, prepare regional plans for a variety of public purposes, and undertake related studies which may include water resources. Water quality management planning has been a significant regional planning agency activity.

2. Water Authorities

Authorities are corporate instruments of the state created by the legislature for the purpose of providing self-liquidating public improvements. Each authority is created by a special act of the legislature. Existing authorities cover a wide range of activity including water supply services. There are four active operating water authorities in the state:

- Erie County Water Authority
- Monroe County Water Authority
- Onondaga County Water Authority
- Suffolk County Water Authority

These water authorities may carry out all functions necessary to provide water supply services, including planning, constructing, financing, operating, and maintaining dams, reservoirs, intake structures, treatment works, pumping stations, storage works, transmission and distribution facilities. The four existing authorities came into being initially through the acquisition of private water companies and subsequently have expanded by capital construction and further acquisitions.

The financial aspects are similar for all the authorities. They are authorized to: (a) issue bonds and notes, (b) establish charges and rates to provide for debt service, operation and maintenance, and proper capital and operating reserves, and (c) enter into agreements with bondholders relative to (a) and (b). The bonds and obligations are secured by revenues only. There is no state or local government obligation. The bonds are revenue bonds.

In 1984 amendments were made to the Public Authorities Law to create the New York City Municipal Water Finance Authority and to allow for the creation of a water board and to prescribe the mechanism by which local governments could establish local authorities to construct and operate water and sewer projects. Laws establishing such authorities were enacted for the City of Buffalo in 1985 and for the City of Albany and Rensselaer County in 1986.

The primary purpose of the new laws is to help cities finance needed water and sewer capital projects through the use of revenue bonds.

3. Counties

The state is divided into 62 counties which are authorized to provide the full spectrum of local government services, including water supply. A board of supervisors or county legislature is the usual governing and legislative body in a county, except for the five counties (boroughs) in the City of New York. New York City is governed by a city council made up of representatives from each borough.

Counties may be organized under county law, home rule charters or special charters enacted by the state legislature. Under county law and charter, counties are authorized to establish water agencies and carry out certain water supply functions. The board of supervisors or other appropriate body may designate any office, official or agency as the county water agency.

Through delegation, county health agencies in many counties in New York State assist in administering major elements of state (DEC and DOH) programs for water pollution control and water supply regulation. For example, a county health department enforces state-established drinking water standards as an agent for the state health department. In some cases, county health agencies administer their own programs, resulting in a more comprehensive overall program than that administered by the state along.

County planning agencies are often involved in environmental or natural resource planning activities, as well as in providing expertise and technical assistance to local government on the development and implementation of local land use controls. These agencies can in many cases assist in tailoring of environmental management activities, including water resources management, to best meet local needs. County public works departments may also have water supply responsibilities, particularly for the construction, operation and maintenance of county water systems.

All counties in New York State outside of New York City have Soil and Water Conservation Districts (SWCD's) as well as cooperative extension offices. These agencies have strong working relationships with the rural/agricultural community in the state. A principal function of the SWCD's is to work directly with farmers to develop farm conservation plans for land resource management of their individual operations, including measures to reduce soil erosion and the migration of soils and soil additives to the water. SWCD's are also an important source at the county level for environmental review data pertaining to soil properties, terrain, and associated watershed characteristics. The State Soil and Water Conservation Committee in the New York State College of Agriculture established policies and coordinates district programs. Cooperative extension is an important vehicle for providing public education and information in rural areas.

County Environmental Management Councils are authorized to review conditions, investigate, report and make recommendations relating to the environment.

The councils receive financial and technical assistance from DEC.

4. Cities and Villages

Cities

Cities are municipal corporations which were created at the will of the residents of communities to meet urban area service needs. Each city has its own charter, drafted to meet specific needs of the area, and so the governmental structure and powers of cities vary greatly.

Cities generally are governed by an elected council with either an elected mayor or an appointed city manager. They have the power to acquire property within and beyond city limits for the purpose of operating a city water supply system. A city may maintain and operate they system, as well as sell or give up its water supply system to a water authority, a county water district or a joint water works system created under General Municipal Law. Elmira and Amsterdam, for example, have municipal water authorities. Cities may also be served by investor-owned water supply systems.

Supervision over municipal city water systems may rest with a variety of organization and officials. There are no legal constraints or control over the rates cities charge for water. They can charge, in effect, what the customers are willing to pay. In addition, when fund surpluses are accrued they may be used for other purposes not related to water supply. Conversely, when deficits occur, other monies can be used to make up the difference. Operation and maintenance expenses usually are covered by water-user revenues which go into the general fund. Capital improvements of municipal water works may be financed by current revenues, reserves, or through the sale of municipal bonds.

Villages

Villages, like cities, are municipal corporations created by community residents to meet local needs including water service. Villages are established under the Village Law and have essentially the same governmental structure and authority. Each village is governed by an elected board of trustees headed by a mayor. The board of trustees can create a board of water commissioners and establish a system of waterworks for supplying the village and its inhabitants with water or acquire an existing private system.

Financial aspects of village water systems are similar to those for cities. Of primary importance is the lack of legal control on use of water revenues. The revenues collected from the sale of water may be used for any legal purpose, and tax funds may be used to cover water expenditures.

Towns

Towns are divided into several classes, based upon population and assessed evaluation. The larger towns are permitted a more complex governmental structure and have authority to perform more extensive services.

A town is governed by an elected town board presided over by the elected supervisor. Towns may provide water service as a town-wide function. The operating procedures are the same as for city and village systems.

5. Water Districts

County

County government can establish a county-wide or part-county water district or extend an existing district. A county district has the power to develop or acquire a water supply for wholesale and/or retail distribution. The county district is operated by an administrative head appointed by the board of supervisors. Some of the functions of the district head relate to adoption of rules governing the terms and conditions of service to customers, establishment of retail and wholesale water rates, purchase of water for resale within the district, and sale of excess water, subject to approval of the board of supervisors.

A county water district may be administered by the county water agency. The agency is authorized to:

1. Assemble data relating to water resources available to the county for water supply purposes.

2. Sponsor and carry out comprehensive water supply studies.

3. Render engineering and related technical services to municipalities located within the county.

4. Act as coordinator for water supply services within the county.

Town

Town special districts may be established for water supply services. The responsibility for formation, operation, and maintenance rests with the town board. The initiative for creating or extending water supply service develops from the people applying to the town board for a district or from the submission of a proposal by the town board to the people. A public hearing is required and all those benefitted must be included within the district. Districts may be part-town or town-wide in an area and may include villages with approval of village boards.

Financing of town water districts is constrained by the requirement that monies collected for water services can only be used to pay for water services in the same town water district. Revenues and expenditures over time must be equal, and ordinarily should be equal each year. Water supply services cannot be used as a revenue raising device in town water districts, in contrast to city or village systems or where water distribution is a town-wide function.

Operation and maintenance costs may be paid from water and other user charges and, if necessary, from property taxes. Capital improvements are financed by full faith and credit town-issued bonds.

6. Joint Water Works Systems

The State Constitution provides that the Legislature may authorize joint undertakings between two or more counties, towns, cities, and villages for any function the municipalities may carry out individually, including water supply. Westchester County has such a joint water works system covering three municipalities.

7. Investor-Owned Water Systems

Investor-owned water works companies are incorporated under state law and may be organized as individual proprietorships, partnerships, or corporations. Most are small developer-owned systems constructed as adjuncts to another enterprise, usually housing construction. The large private systems are investor-owned stock companies which are operated as water supply utilities.

Capital for the investor-owned companies comes from the private entrepreneur or the stockholder. Operating revenue is obtained from the rates charged for water and related services. The financial matters of private water companies are dictated and regulated by the PSC.

C. Federal Agencies

There are three principal water agencies with important responsibilities relating to water resources management in New York State. These are the United States Environmental Protection Agency (USEPA), the United States Geological Survey (USGS) in the Department of Interior, and the United States Army Corps of Engineers (COE). Two other federal agencies, Housing and Urban Development (HUD) and Farmers Home Administration (FHA), also have important programs relating to water supply system improvements.

1. U.S. Environmental Protection Agency

The USEPA is the agency responsible for most of the federal regulatory programs providing for protection of the environment, including several which pertain to water resources management. These include, in particular, programs under the Clean Water Act (CWA); the Safe Drinking Water Act (SDWA); and the Resource and Recovery Act (RRA).

EPA policy in administering these programs is generally to delegate may of the specific program activities to the states upon request and upon attainment of legislative requirements; to provide flexibility for states to tailor the programs to most effectively meet environmental needs within each state, to the extent permitted by statute; to oversee state performance in carrying out delegated national programs which use federal grants; and to support the states through provision of technical expertise and research.

New York State has received delegation of several of these federal programs. Of particular note in relation to the state's water resources management activities are delegated programs under the CWA, SDWA, and RRA. The authorities in these acts are generally mirrored by comparable state legislation, and the delegated programs have in the past decade provided essential funding support to assist strong state programs in water pollution control, public water supply regulation, and solid and hazardous waste management.

Not all elements of the federal program are or can be delegated. Examples of program activities for which USEPA maintains direct responsibility include:

- Development of national drinking water quality standards.

- Designation of "sole source" aquifers under the Safe Drinking Water Act.

- Underground Injection Control under the Safe Drinking Water Act.

New York State has been generally in accord with the policy of delegating major portions of the federal programs to the states. Delegation, accompanied by appropriate levels of funding to carry out the work, allows for the tailoring of programs to most effectively meet the needs and conditions in each state. Exceptions are in areas where a strong federal role is essential to provide a reasonable level of equity and consistency among states. An example is the need for USEPA to move more aggressively to establish national drinking water standards.

2. U.S. Geological Survey

The USGS was originally created as a Bureau within the Department of Interior to classify public lands as to their suitability for mining and irrigation, and to evaluate the geologic structure and mineral resources of the nation. The survey's authority and responsibilities have expanded over the years to include topographic mapping, geochemical and geophysical studies, stream gaging, and water supply assessments, as well as several other activities.

Of principal importance for water resource management is the Survey's Water Resources Investigation Program, which includes (a) water resources appraisals describing the occurrence, availability, and characteristics of water resources; (b) statewide networks of monitoring stations that provide long-term records of surface streamflows, groundwater elevations, and some water quality measurements; and (c) specific research to study local or regional water problems as well as critical water problems of national scope or interest. Activities within the Water Resources Investigation Program are usually conducted through cooperative funding agreements with state and local government agencies under which the USGS generally underwrites half of the project cost.

Since the early 1900's, the survey, has maintained a District Office in Albany to direct its overall program within New York State. A major sub-district office is maintained in Long Island because of the particularly important groundwater aquifer system in that area. Other sub-district offices are maintained in Ithaca and Albany to serve the western and eastern portions of the upstate area, respectively.

3. U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers, in cooperation with other federal, state and local agencies, is engaged in the development and utilization of water resources in the river basins of the nation. Since the Corps is organized by river basins, their work in New York comes within the jurisdiction of more than one office; specifically five districts and three divisions.

Under Section 214 Public Law 89-298 and Section 22 Public Law 93-251, the Corps of Engineers is authorized to cooperate with New York State in preparing comprehensive plans for development, utilization and conservation of water and related resources. Funds available to the Corps for this program have averaged about $200,000 per year and in recent years have been used mainly for water supply infrastructure studies.

Water supply is a significant aspect in the planning of river basin works under Section 6 of the Flood Control Act of 1944, the Secretary of the Army authorized to make contracts with state municipalities, private concerns or individuals for domestic and industrial uses of surplus water that may be available at Corps of Engineers projects. The Water Supply Act of 1958 makes provisions for water supply storage in federal navigation, flood control, irrigation or multi-purpose projects. Under terms of the Water Supply Act, local interests may reimburse the federal government over a period of 50 years for the costs involved.

The Corps of Engineers conducted the Northeastern United States Water Supply (NEWS) study authorized under Title I of the 1965 Flood Control Act (Public Law 89-298). The Act directed the Secretary of Army, acting through the Chief of Engineers, to cooperate with federal, state, and local agencies in preparing plans in accordance with the 1965 Water Resources Planning Act (PL 89-80) to meet the long-range water needs of the Northeastern United States. From 1966 to 1978 the NEWS study produced a series of reports outlining water supply needs and alternatives. The Northern New Jersey-New York City-Western Connecticut Metropolitan Area was designated as one of three regions with the most urgent water supply problems. The regional study was completed in 1978 with recommendations for various actions, including more detailed study of a water supply project utilizing the Hudson River.

The Corps Section 214/22 program and the NEWS study have provided important water resources and water supply system information for the state program.

4. Farmers Home Administration

The Farmers Home Administration (FmHA) conducts a program of direct aid and loans for water and waste disposal systems for rural communities. The program is limited to communities under 10,000 people that are unable to finance such projects from their own resources or through commercial credit at reasonable rates. The purpose is to upgrade water and sewer systems in areas of rural poverty. Supplemental grants of up to 75% of total project costs are used to assist users in meeting capital investment needs. A similar program does not exist for larger cities or impoverished urban areas.

5. Department of Housing and Urban Development

The Department of Housing and Urban Development's (HUD) community development block grant program gives money to cities of over 50,000 (or counties over 200,000) as entitlement grants for a variety of locally designed programs. These funds may be used for water and sewer projects. The small cities discretionary grant program provides similar aid to cities under 50,000 and may also be allocated to water and sewer projects.

D. Interstate Agencies

By virtue of its position as a headwaters state for major rivers, New York has been a member of numerous interstate agencies and has been involved in numerous interstate activities relating to water resources. The most important agencies currently active are the Delaware River Basin Commission, Susquehanna River Basin Commission, Great Lakes Commission and Interstate Environmental Commission.

1. Delaware River Basin Commission

The Delaware River Basin Commission (DRBC) was created in 1961 by a compact among the states of New York, Pennsylvania, New Jersey and Delaware, and the federal government. The agency is primarily responsible for the planning, conservation, use, development, management and control of the water and related natural resources of the Delaware River Basin.

The commission also has extensive authority over allocations, diversions and releases of water in the basin.

The 12,750-square mile Delaware Basin supplies water to more than 13 million inhabitants of the New York City and Philadelphia metropolitan areas.

The commission is an agency in which the participating states are full operating partners with the federal government. Its five members are the governors of the four signatory states and the Secretary of the Interior. New York City, through the mayor, serves in an advisory capacity to New York State because of its water supply development in the Upper Delaware River Basin.

The commission's plan for the basin includes water supply, flood control, hydroelectric power, recreation, water quality management, fish and wildlife preservation, soil conservation and other functions.

The commission's administrative, planning and construction costs are financed by the signatory parties.

2. Susquehanna River Basin Commission

The Susquehanna River Basin Commission (SRBC) was created by the Susquehanna River Basin Compact which became effective with the signature of the President on December 24, 1970. The commission is created as a body politic and corporate, with succession for the duration of the compact, as an agency and instrumentality of the governments of the signatory parties which are the states of New York, Pennsylvania, and Maryland, and the federal government. The commission is created for the proper management and effective utilization of the water and associated land resources of the Susquehanna River Basin. The commission functions in a manner similar to the Delaware River Basin Commission.

3. Great Lakes Commission

The Great Lakes Commission (GLC) is established by a compact among the States of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin.

The goal of the commission is to promote the orderly, integrated and comprehensive development, use and conservation of the water resources of the Great Lakes Basin. In its work it considers all aspects of the resources of the basin, including industrial, commercial, agricultural, residential and recreational use. However, the commission's powers are limited to study and recommendation.

The New York State delegation consists of five commissioners appointed by the governor. The operating expenses are financed by the signatory states.

4. Interstate Environmental Commission

The Interstate Environmental Commission (formerly Interstate Sanitation Commission) is responsible for anti-pollution measures affecting coastal, estuarial and tidal waters in a district that includes parts of New York, New Jersey and Connecticut. The district extends from Sandy Hook in New Jersey, including all of New York Harbor, north on the Hudson River to the northerly boundaries of Westchester and Rockland counties, then easterly to Long Island Sound, then to New Haven on the Connecticut shore and Port Jefferson on the north shore of Long Island. Along the south shore of Long Island, the district extends easterly to Fire Island Inlet. The commission has investigative power and may resort to the courts to compel enforcement of commission orders. The commission seeks to develop better coordination and more active cooperation among the interested entities toward the construction of necessary waste treatment works to improve and protect water quality in the district.

In addition, it has been given responsibilities relating to air pollution problems affecting New York and New Jersey.

Appendix C

Glossary: A reference for terms used in this report.

Aquifer	A geological formation that is capable of yielding significant quantities of water to a well or spring. 1. Primary aquifer: one already heavily used for public water supply. 2. Principal aquifer: a known or potential source for a water supply, but not yet heavily developed.
Average Day Demand	The total amount of water produced by a system in one year, divided by the number of days in the year. See also maximum Day Demand.
C Factors	A measure of interior roughness in pipeline, used by engineers to determine the friction encountered by water moving through the pipe, and the implications for increased pumping.
Consumptive Use	Any water use that does not return water directly to surface or groundwater. Examples are industrial processing or nutritional uses by humans, plants and animals.
Demand	The total amount of water required from a water supply system; may vary be season, types of use, conservation efforts, infrastructure condition.
Dependable Yield	The maximum amount of water than can be withdrawn from a source without depleting that source under the drought of record.
Distribution System	That portion of a water supply system that conveys treated water from the transmission system to the customers' service connections; includes any necessary pumps and storage tanks.
Drainage Basin	The land formations that cause runoff from rain and snow to flow towards a stream system; in American usage, synonymous with watershed. There are 17 major drainage basins in New York State.
Drought of Record	Conditions prevailing during the most severe drought recorded in the region; 1964 is generally used as a baseline in New York State.

Excess Capacity	The amount of available raw water (from a source) or treated water (from a system) greater than is needed by consumers; more precisely, the amount of water available in a water supply system above the maximum day demand of the system during the drought of record.
Fire Flow	Water available in sufficient amount and pressure for fire fighting, usually through hydrants.
Groundwater	The water lying below the earth's surface in a saturated zone where all the interconnected openings between soil particles are filled with water. The source of water for nearly 6 million New Yorkers; half of state's groundwater use is on Long Island.
Infrastructure	The permanent equipment and facilities to operate a water supply system, such as water treatment plants, pumps, pipelines, storage tanks and reservoirs.
Interconnection	Transmission or distribution lines connecting two otherwise independent water supply systems to add capacity under emergency flow conditions. Connections may benefit one or both systems.
Low Flow Augmentation	Release of water from a reservoir to a stream to maintain a desired flow during periods of reduced stream flow.
Maximum Day Demand	The largest quantity of water required from a water system in a single day during the year; where there is no clear pattern established in a system, it is estimated to be 150% of average daily demand.
Municipal Water System	A public or investor-owned utility, operated by a supply municipality, water district or authority, or by a private corporation, supplying water year-round to a municipality, with at least five service connections or regular service to at least 25 individuals daily.
Non-Consumptive Use	Any type of use that returns water to ground or surface waters nearly unchanged in quantity. An example is industrial cooling.
Peak Demand	The greatest amount of water required from a supply system on an hourly or seasonal basis.
Per Capita Use (gpcd)	The average number of gallons used each day by each person served by a supply system, measured in gallons per capita per day (gpcd); calculated by dividing average day demand by the population served by the system. Gpcd usually includes all of a systems' users - commercial, industrial and institutional, as well as residential - and and thus reflects more than actual personal use.

Permitted Withdrawl	The amount of water a system is permitted (by New York State or, in the case of a purchased supply, by agreement with the water seller) to withdraw from the source.
Raw Water	Untreated water, in the source.
Served Population	The number of people who receive water from a municipal supply system.
Source	A lake, stream, reservoir or aquifer that is used as a water supply for human use; a supply system that sells water to a purchasing system.
Storage	1. Raw water storage: the amount of water, usually measured in million gallons (mg), available in natural lakes; and ponds or manmade impoundments; reservoirs. 2. Clean water storage: the amount of treated water (mg) that can be reserved in a water supply system for use during peak demand or for emergencies.
Supplemental Supply	An additional water source for a system, used to meet peak demand or for emergencies.
Surface Water	Oceans, rivers, lakes or reservoirs on the earth's surface; for water supply purposes, fresh waters only; may contribute to and receive water from aquifers; source for more than 11 million New Yorkers.
System Management	All the aspects of running a water supply system, including financing, record-keeping, operator training, operations, maintenance, contingency planning, conservation, controlling supply, meeting demand and protecting quality.
Transmission System	Water supply facilities that carry water from the source to the treatment plant and from the plant to the distribution system; includes pumps, screens and pipes.
Treatment	Chemical or physical processes used to remove contamination from drinking water, including processes to remove suspended particles, to adjust pH, and to correct odor, taste or color.
Unaccounted-for water	The difference between the amount of water produced and the amount of water consumed (sold). It includes water used for firefighting, street cleaning, system flushing (usually 5% of production) and water lost through leaks and inaccurate metering (which normally should not exceed 15% of production).

Universal Metering	Metering of service connections to buildings, not including metering of individual apartment units.
Water Conservation	Practices of water use that avoid needless waste, including drought contingency plans, public education programs, and leak detection and control programs.
Water Resource	The fresh water that is available for all uses, including water supply, navigation, agriculture, power generation, recreation, fish and wildlife habitat; ambient water in surface water bodies or groundwater aquifers.
Watershed	See drainage basin.
Watershed Rules and Regulations	Locally adopted legal measures which control activities not only in the drainage basin of streams, lakes and reservoirs, but also for the drainage areas (recharge zones) affecting principal or primary aquifers. (See aquifer).
Water Supply	The amount of water developed or targeted for use, limited by topographical and climate conditions.
Water Supply Systems	Public or investor-owned systems, including sources, their watersheds, and water collection, storage, treatment, transmission and distribution facilities.

Appendix D

References

1. New York State Department of Environmental Conservation, Substate Regional Studies and Strategies, 1986-1989.

2. Ibid, New York State Water Resources Management Strategy (Draft), Albany, New York, May, 1987.

3. Ibid, Local Financial Capability Analysis Report, Water Resources Management Strategy, Albany, New York, June 1987.

4. New York State Department of Environmental Conservation and New York State Department of Health, Water Supply Systems Interim Inventory Report, Albany, New York, 1985.

5. New York State Department of Environmental Conservation, Final Long Island Groundwater Management Program, Albany, New York, June, 1986.

6. Ibid, Final Upstate New York Groundwater Management Program, Albany, New York, May, 1987.

7. Ibid, Statewide Water Quantity Strategy, (Unpublished Draft), Albany, New York, 1984.

8. Ibid, The Coordinated Program for the Planning and Development of the Water Resources of New York State, Albany, New York, 1970.

9. Ibid, Water Bulletin, (Various Issues), Albany, New York.

10. New York State Senate Research Service Task Force on Critical Problems, Diagnosing Water System Problems in New YOrk - Pipe Dreams or Planning?, Albany, New York, 1985.

11. Ibid, Water Conservation, The Hidden Supply, Albany, New York, 1986.

12. New York State Department of Health, Report on Ground-Water Dependence in New York State, Albany, New York, 1981.

13. Cornell University, Management of New York State's Water Resources, Options for Modernization, (Unpublished), Ithaca, New York, 1978.

14. SUNY College of Environmental Science and Forestry, Water Supply Source Protection Rules and Regulations Project, Syracuse, New York, 1981.

15. Mayor's Intergovernmental Task Force on New York City's Water Supply Needs, Increasing Supply, Controlling Demand, Interim Report, New York, New York, 1986.

16. Ibid, Managing for the Present, Planning for the Future, Second Interim Report, New York, New York, December, 1987.

17. Temporary State Commission on the Water Supply Needs of Southeastern New York, Institutional Arrangements and Alternative Futures, Albany, New York, 1973.

18. Ibid, Water Law in Southeastern New York, Albany, New York, 1972.

19. Ibid, Proceedings State Agency Conferences, Albany, New York, 1972.

20. Massachusetts Water Resources Commission, Massachusetts Water Supply Policy Statement, 1984 Update, Boston, Massachusetts, 1984.

21. Great Lakes and Water Resources Planning Commission, Water Resources for the Future, Michigan's Action Plan, Lansing Michigan, September, 1987.

22. National Conference of State Legislatures, Water Resources Management Issues and Policy Options, Denver, Colorado, 1984.

23. American Water Works Association, Policy Statements, Denver, Colorado, 1984.

24. United States Geological Survey, National Water Summary, 1984-Hydrologic Events, Selected Water Quality Trends and Ground-Water Resources: Water Supply Paper 2275, Washington, D.C., 1984.

25. Ibid, National Water Summary, 1985 - Hydrologic Events and Surface Water Resources: Water-Supply Paper 2300, Washington, D.C., 1985.

26. Health, Ralph, C., Groundwater in New York, Bulletin GW 51, Washington, D.C., 1964.

27. Hogan, Barbara, A Primer on Groundwater, The Conservationist, New York State Department of Environmental Conservation, 1984.

28. United States Army Corps of Engineers, North Atlantic Division, Water Resources Development in New York, New York, New York, 1975.

29. United States Water Resources Council, Inventory of Federal Assistance Programs for Urban Water Supply Systems, Washington, D.C., 1980.